



Animal Production

STUDENT MODULE

GRADE 11



FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
MINISTRY OF EDUCATION

Animal Production

STUDENT MODULE

GRADE 11

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List of Modules

No.	Modules	Page No.
Module I	Dairy Cattle Production Practices	1
Module II	Basic Kaizen	122
Module III	Cattle Fattening Practices	187
Module IV	Professional Ethics	252
Module V	Pasture Establishment and Forage Preservation	304
Module VI	Poultry Production Practices	355

Introduction to the Student Module

Animal production refers to the process of rearing and managing animals for various purposes, such as food production, fiber production, labor, companionship, or research. It encompasses the breeding, feeding, housing, healthcare, and overall management of animals to ensure their well-being and productivity. Animal production plays a significant role in agriculture and provides essential products for human consumption and other needs.

Following the advent of the new Ethiopian Education and Training Policy (2023), Career and Technical Education (CTE) has evolved as a field in transition. It predominantly focuses on preparing students for work, life, further education as well as employment.

The aim of modules is to provide Grade 11 students the chance to develop skills and get training that will provide access to “Level One” jobs, while also meeting employers’ demands for qualified worker. Furthermore, modules also aim to provide students of Grade 11 with the academic and technical skills, knowledge, and attitude necessary to succeed in future careers and to become lifelong learners.

For grade 11 six modules are designed to be given, namely, dairy cattle production practices, basic kaizen, cattle fattening practices, professional ethics, pasture establishment and forage preservation, and poultry production practices.

As indicated in the curriculum framework every year, schooling at all levels begins on the first week of September and ends on the fourth week of June. Learning and training time for all levels will be 10 months or 35 weeks. In level 1 the total periods of grade 11 for both semesters without break is 321.

Those modules are a national standard document used to develop teaching, learning and training materials and also used for teaching, training, learning, assessment, monitoring and evaluation purpose.

MODULE I

DAIRY CATTLE PRODUCTION

PRACTICES



Contents

No		Contents	Page
		Module Description	1
1		Unit One: Dairy Farm Establishment	2
	1.1	Dairy Farm Site Selection	3
	1.2	Economic Importance of Dairy Cattle Production	5
	1.3	Dairy Cattle Housing and Facilities	6
		Unit Summary	19
		Unit Review Questions	20
2		Unit Two: Dairy Cattle Feeding	28
	2.1	Dairy Cattle Feed Sources	29
	2.2	Feeding Strategies of Dairy Cattle	31
		Unit Summary	39
		Unit Review Questions	41
3		Unit Three: Dairy Cattle Management Practices	41
	3.1	Body Condition Scoring	42
	3.2	Hoof Trimming	48
	3.3	Identification	51
	3.4	New Born Calf Management	55
	3.5	Heifer Management	60
	3.6	Dairy Cow Management	61
	3.7	Maintaining Proper Hygiene and Health	65
	3.8	Record Keeping	73
		Unit Summary	78
		Unit Review Questions	78
4		Unit Four: Dairy Cow Milking Operation	81
	4.1	Occupational Health and Safety Hazards	82
	4.2	Milking Methods	87
		Unit Summary	95
		Unit Review Questions	96
5		Unit Five: Dairy Cattle Breeding	98
	5.1	Dairy Cattle Breeds	98

No		Contents	Page
	5.2	Dairy Cattle Selection	103
	5.3	Breeding System	114
	5.4	Heat Detection	116
	5.5	Mating Procedures and Handling Techniques	120
		Unit Summary	121
		Unit Review Questions	121
		Project Work	123
		References	124

Module Description

This module describes the performance outcomes, skills, knowledge and attitude required to:

- Establish dairy farm
- Prepare feeds for dairy cattle
- Undertake dairy cattle management
- Undertake milking operation
- Apply breeding practices of dairy cattle

UNIT 1

Dairy Farm Establishment

Learning outcomes

At the end of this unit, the students will be able to:

- Select suitable site for dairy cattle production
- Identify economic importance of dairy cattle production
- Select dairy cattle housing and fulfill facilities

Key Terms

- Housing
- Facilities

Unit Introduction

What are the primary requirements to be considered to establish dairy farm?

Establishing a dairy farm involves careful planning and meeting various requirements such as adequate and suitable land that can accommodate the desired herd size, grazing areas, barns and necessary infrastructure. Proper facilities such as well-designed barns, milking parlors, storage spaces for feed and milk are essential for the comfort, health, and productivity of the dairy cattle. Adequate ventilation, lighting, and waste management systems are also crucial considerations of dairy farm.

1.1. Dairy farm site selection

Dairy farm site selection involves to the process of identifying and choosing appropriate location for establishing a dairy farming operation. The objective of site selection is to accommodating desired number of cattle providing necessary resources, and meeting the needs of a productive and efficient dairy farming operation. When choosing a location for establishing a dairy cattle farm, several important factors should be taken into account. These criteria include:

- **Climate:** Dairy cattle thrive in moderate temperature ranges, typically between 4°C and 24°C.
- **Topography:** A suitable topography ensures proper natural drainage, allowing excess water to flow away easily. As a general guideline, a slope of 2 to 5 percent is often considered suitable for dairy farming.
- **Water:** Adequate and reliable water sources are essential for dairy farming. The site should have access to clean water for the cattle to drink, as well as for cleaning purposes and irrigation if needed.
- **Feed resources:** Consider the availability of grazing land, crop production for forage, and proximity to feed suppliers.
- **Land availability and suitability:** Sufficient land is necessary for future expansion opportunities, grazing, housing facilities, storage, and manure management. The soil should be fertile, well-drained, and capable of supporting forage crops. Balanced soil texture, known as loam, is considered ideal for dairy farming.
- **Proximity to markets:** It is important to consider the proximity of the site to markets where dairy products can be sold and feeds can be purchased.
- **Infrastructure:** Evaluate the availability of infrastructure necessary for dairy farming, such as roads, electricity, and veterinary services.

- Labor availability: Dairy farming requires dedicated and knowledgeable staff for tasks such as milking, feeding, veterinary care, and general farm management
- Environmental considerations: Consider factors like proximity to residential areas, water bodies, and environmentally sensitive areas. Ensure that waste management practices, such as manure handling and disposal, comply with local regulations and minimize environmental impacts.

Practical activity-1	Select suitable dairy farm site
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A. Resource required

- Paper and pen: For jotting down observations during site visits
- A measuring tape: to measure area coverage
- Local reports and data: To gather any available local reports, data, or studies related to agriculture, land use, climate, or water resources in the area

B. Procedures

1. Prepare checklist
2. Conduct different site visits for land proposed to establish dairy farm: During the site visits do not forget to consider the site selection criteria.
3. Observe the sites critically in different direction
4. Gather the required information as per criteria listed in the checklist
5. Evaluate each of the sites per the criteria included in the checklist
6. Compare the sites and include the expert advice and put in rank to facilitate site selection decision

Self-check question -1	Written test
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Write the correct answer for the following questions

1. Write at least six important factors required to consider during selecting a site for a dairy farm
2. Dairy cattle can thrive in moderate temperature ranges, typically between ____ and ____ °C.

1.2. Economic Importance of Dairy Cattle Production

The economic importance of dairy cattle production refers to the significant role that this sector plays in a country's economy. It encompasses the various ways in which dairy cattle farming and the production of milk and dairy products contribute to economic development, income generation, employment, and trade. These aspects collectively contribute to the overall economic growth, poverty reduction, and well-being of the country. The economic importance of dairy cattle production in detail includes the following:

- **Milk production and sales:** Dairy cattle are primarily raised for milk production, which generates revenue through the sale of fresh milk, processed dairy products (such as cheese, butter, yogurt, and ice cream), and other dairy derivatives.
- **Employment and income generation:** Dairy cattle production creates huge job opportunities and income from heifer multiplication, milk production, male calves selling for breeding, breeding service, veterinary service, feed manufacturer and suppliers and equipment manufacturer and suppliers. The industry also supports jobs in milk processing, transportation, marketing, and retail sectors.
- **International trade:** Dairy products are among the most traded agricultural commodities worldwide. Countries with surplus milk and dairy products can export them to meet global demand, contributing to foreign exchange earnings and strengthening trade relationships.
- **Value-added products and by-products:** Dairy cattle production generates value-added products beyond milk, such as cheese, butter, yogurt, and ice cream. These processed dairy products often have higher profit margins compared to raw milk, contributing to increased revenue for dairy farmers and processors. Additionally, by-products of dairy production, like manure, can be used for fertilizer, biogas production, and other agricultural applications.
- **Livestock sales and breeding:** Dairy cattle breeding and sales contribute to the livestock industry's economy. High-quality dairy cattle can be sold to other farmers or breeding operations, both domestically and internationally. Breeding programs focus on improving the genetics of dairy cattle, leading to higher milk yields, better disease resistance, and improved overall productivity. The sale of breeding stock and genetic materials, such as semen and embryos, can generate substantial revenue for dairy producers.

- Rural development and community support: Dairy farming often takes place in rural areas, where it plays a crucial role in supporting the local economy. Dairy farms provide employment opportunities for local residents, support related businesses and services, and contribute to the overall well-being of rural communities.

Practical activity-2	Identify the income generating activities of dairy farm
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A. Resource required

- Paper and pen: For jotting down observations during site visit
- Documented data: To obtain information regard to income generating activities of the farm

B. Procedure

1. Prepare checklist: When preparing checklist, you should consider dairy farm income generating activities
2. Conduct visiting different dairy farm
3. Gather the required information regard to income generating activities. You can refer documented data on the farm or interview the farm owners
4. Write the information you obtain on the prepared checklist

Self-check question -2	Written test
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Write the correct answer accordingly

1. Define the economic importance of dairy cattle production
2. List at least four (4) the economic importance of dairy cattle production

1.3. Dairy Cattle Housing and Facilities

Dairy cattle housing and facilities play a crucial role in providing a comfortable and productive environment for dairy cows. Proper housing provides a comfortable and safe environment for the cattle, promotes their health and well-being, and supports optimal milk production.

1.3.1. Dairy cattle housing

Dairy cattle housing refers to the facilities and structures designed to provide a comfortable and productive environment for dairy cows. Proper housing is essential for the well-being and productivity of the animals. There are different types of housing systems used for dairy cattle, and the choice depends on factors such as climate, available land, and management preferences.

A. Conventional house

Conventional house refers to the housing structure specifically designed and built to accommodate dairy cattle. This type of housing provides shelter, comfort, and management facilities for the cows, allowing for efficient management and milk production. It typically involves various structures and facilities designed to provide suitable living conditions for dairy cows. Common elements of conventional housing for dairy farms are as follows:

- **Barns:** Dairy farms often have barns or cowsheds where cows are housed. These buildings provide shelter and protection from the elements. Barns may be open-sided or enclosed, depending on the climate and specific farming practices.
- **Stalls:** Within the barn, individual stalls are provided for each cow. Stalls allow cows to have their own space and prevent them from competing for resources. Stalls are usually made of metal or wood and are designed to be comfortable and hygienic.
- **Bedding:** The stalls are typically bedded with materials such as straw, sawdust, or sand. Bedding helps provide comfort to the cows and absorbs moisture.
- **Feed bunks:** Dairy cows require a balanced diet, and feed bunks are used to provide them with a constant supply of feed. These are trough-like structures where cows can access their feed easily. Feed bunks are usually placed in a separate feeding area within the barn.
- **Waterers:** Access to clean water is crucial for dairy cows. Waterers or water troughs are installed in the barn or nearby areas to ensure cows have a constant supply of fresh water.
- **Milking parlor:** A dairy farm typically has a dedicated milking parlor or milking area. This is where cows are milked, either manually or using automated milking systems. The milking parlor may have individual milking stations or a rotary system to accommodate multiple cows simultaneously.
- **Calf housing:** Calves require separate housing to ensure their proper growth and development. Calf hutches or pens are commonly used to provide individual or group housing for young calves. These structures provide protection while allowing for proper ventilation and movement.

- Waste management: Dairy farms need efficient waste management systems to handle manure and other byproducts. This may involve storage facilities for manure, along with systems for proper disposal or utilization of waste.



Figure 1. Conventional house types

B. Loose house

A loose house, also known as a loose housing system or loose housing barn, is a type of housing arrangement for dairy cows. In a loose house system, cows are not confined to individual stalls but are given freedom to move and socialize within a larger open space or barn. Here are some key features and benefits of a loose house for dairy cows:

- Open space: In a loose house, cows have access to a larger open space or barn where they can move around freely. This allows them to exhibit natural behaviors such as walking, stretching, and socializing with other cows.
- Resting areas: Within the loose house, designated resting areas are provided for the cows. These areas are typically bedded with comfortable materials like straw, sand, or mattresses to ensure cow comfort and promote resting and lying down.

- **Feeding areas:** Separate feeding areas are allocated within the loose house, where cows can access their feed and water. Feed bunks or feed alleys are designed to accommodate multiple cows simultaneously, providing easy access to feed and minimizing competition.
- **Cow comfort:** Loose housing systems prioritize cow comfort by allowing cows to move around, lie down, and interact freely. The provision of comfortable bedding, adequate ventilation, and proper temperature control helps maintain cow well-being and health.
- **Social interaction:** Cows are social animals, and loose housing allows them to interact with each other more freely, forming social bonds and reducing stress. Improved social interaction can positively impact cow behavior and welfare.
- **Health and hygiene:** Proper management practices, such as regular cleaning of resting areas and effective manure management, contribute to maintaining a clean and hygienic environment in the loose house. This helps minimize the risk of diseases and enhances cow health.
- **Cow behavior and productivity:** Loose housing systems aim to create an environment that aligns with natural cow behavior. When cows have more freedom of movement and comfortable resting areas, it can positively affect their behavior, reduce stress, and potentially enhance milk production and overall productivity.
- **Flexibility and adaptability:** Loose houses can be designed to accommodate different herd sizes and management practices. They offer flexibility in terms of grouping cows, separating animals based on their needs, and adapting to changes in herd size or composition.



Figure 2: Loose house types

1.3.2. Housing facilities

Housing facilities for dairy cattle are designed to provide a comfortable and controlled environment that supports their well-being, productivity, and health. These facilities are essential in modern dairy farming to protect the cattle from adverse weather conditions, facilitate efficient management practices, and ensure optimal milk production. The housing facility for dairy cattle includes:

Constructing stall: A stall is an individual enclosure within a barn or housing structure that provides a dedicated resting and feeding space for an individual cow. The primary purpose of a stall is to provide a controlled environment for individual cows to rest, eat, and be milked. It allows for individual cow management and monitoring. The average width of a dairy cow stall is around 1.2 to 1.5 meters (4 to 5 feet). This provides enough space for the cow to comfortably lie down and move within the stall. The average length of a dairy cow stall is around 2.4 to 2.7 meters (8 to 9 feet). This allows the cow to fully stretch out while lying down. The stall height should accommodate the cow's height, typically around 1.2 to 1.4 meters (4 to 4.5 feet), providing enough headroom for the cow to stand comfortably.



Figure 3: Individual cow stall

Resting area and cow comfort: Resting areas and cow comfort are closely linked in dairy farming. Providing a suitable resting area is essential for promoting cow comfort, which, in turn, has a significant impact on cow health, welfare, and productivity. Here's how resting areas contribute to cow comfort:

- The choice of bedding material in the resting area can greatly influence cow comfort. Soft and comfortable bedding, such as straw, sand, or mattresses, helps cushion the cow's body and joints, reducing the risk of injuries and promoting relaxation.
- Maintaining a clean and hygienic resting area is crucial for cow comfort. Regularly removing manure, urine, and soiled bedding helps prevent odors, reduces the risk of bacterial infections, and provides a clean and inviting space for cows to rest.
- The resting area should provide enough space for cows to comfortably lie down, stand up, and turn around without restriction. Ample space allows cows to adopt their preferred lying positions, stretch their legs, and move freely within the resting area. The resting space requirement is similar with the individual cows stall space in the house.
- The flooring surface in the resting area should provide good traction and comfort for cows. Slippery or uneven surfaces can lead to injuries and discomfort. Consider using rubber mats, grooved concrete, or other suitable flooring materials to ensure a comfortable surface for resting.



Figure 5: Resting area

Feeding trough: Feeding troughs serve as designated areas where cows can access their feed. They provide a controlled environment for feeding, ensuring that each cow has access to the appropriate amount of feed.

- In some cases, a feed barrier may be installed along the front edge of the feeding trough to prevent cows from stepping into the trough or pushing feed out. This barrier helps maintain feed quality and reduces wastage.

- The width of a feeding trough for dairy cows should typically be around 60 to 75 centimeters (24 to 30 inches). This width allows enough space for cows to access the feed without overcrowding or competition.
- The length of a feeding trough can vary depending on the number of cows being fed simultaneously. As a general guideline, the length should be approximately 2 to 2.5 meters (6.5 to 8 feet) per cow. This provides enough space for each cow to access the feed comfortably.

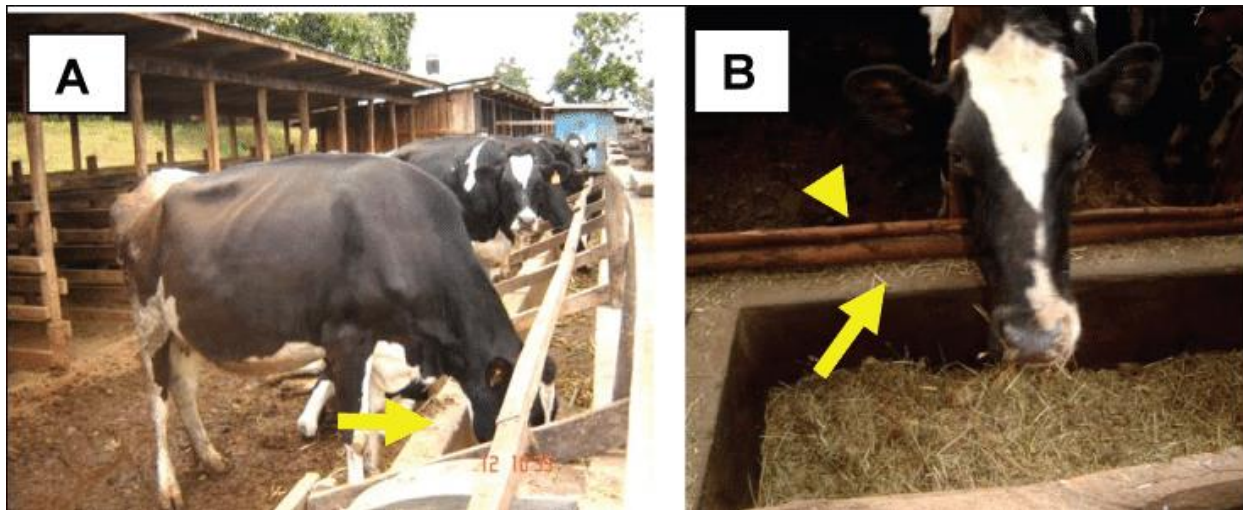


Figure 6: Feeding trough

Water trough: Water troughs are containers or structures designed to hold and provide water to dairy cows within their housing or shed. They offer a convenient and accessible water source for cows to drink and maintain proper hydration. Water troughs for dairy cows can come in various designs and materials. Common options include troughs made of concrete, plastic, or stainless steel. The recommended average size of the water trough:

- A length of approximately 90 to 120 centimeters (36 to 48 inches) is typically suitable for a single cow. This length allows the cow to comfortably access the water while resting. A width of around 30 to 45 centimeters (12 to 18 inches) is generally sufficient for a single cow.
- The depth of the water trough should allow the cow to easily submerge its muzzle and drink water comfortably. A depth of about 30 to 45 centimeters (12 to 18 inches) is commonly recommended for a single cow.

Calving and maternity areas: Calving and maternity areas in dairy cow management are dedicated spaces designed to provide a safe and comfortable environment for cows during the calving process and post-

calving period. Group" calving refers to a situation where multiple cows are housed together in a shared calving area. In this setup, there is a larger space designated for calving, and multiple cows have access to it simultaneously. The area may be divided into individual pens or sections within the larger space to provide privacy and separation between cows. Individual" calving refers to a scenario where each cow has its own separate calving pen or area. In this setup, cows are housed individually during the calving process and immediate post-calving period. Individual calving pens are typically smaller, providing a private and isolated space for each cow. The specific facilities required for both group and individual calving arrangements would generally include:

- Calving pens or areas: These are individual or group spaces where cows can give birth and stay during the calving process. The pens should be appropriately sized, provide comfortable bedding, and ensure privacy and separation from other cows.
- Clean and comfortable bedding, such as straw, sand, or specialized calving mats, should be provided to create a soft and hygienic surface for the cow and newborn calf.
- Good lighting, clear sightlines, and observation platforms are essential for closely monitoring cows during labor and post-calving. These tools enable early detection of any complications and timely assistance.
- Adequate supplies of cleaning and disinfection products should be available to maintain good hygiene in the calving and maternity areas. This includes cleaning equipment, disinfectants, and appropriate waste disposal methods.
- A designated area within the maternity area is needed for collecting, testing, storing, and administering colostrum to the newborn calves. This area should have facilities for proper storage and handling of colostrum.
- Ensure that the calving and maternity areas have access to clean water for the cows and electricity for lighting and any necessary equipment.
- Proper ventilation is crucial to maintain good air quality in the calving and maternity areas. Adequate airflow without drafts helps create a comfortable and healthy environment for the cow and calf.
- Equipment such as obstetric chains or ropes, lubricants, disinfectants, and other tools necessary for assisting with calving should be readily available in case intervention is needed.

Calves pen: When designing a calf pen, it's important to provide a clean, comfortable, and safe environment that promotes the health and well-being of the calves. General guidelines for calf pen dimensions and facilities:

- **Pen size:** The size of the calf pen will depend on the number of calves housed and the space available. As a general rule of thumb, provide a minimum of 30-40 square feet (2.8-3.7 square meters) of space per calf. This allows them to move around, lie down, and have some separation.
- **Pen divisions:** If multiple calves are housed together, consider dividing the pen into individual compartments or sections to prevent competition and promote individual feeding. Dividers can be solid or slatted to allow for visual and social interaction between calves while preventing physical contact.
- **Bedding:** Provide comfortable bedding material in the pen, such as straw, wood shavings, or sand. Bedding helps keep the calves clean, provides cushioning, and helps regulate temperature.
- **Water supply:** Ensure a clean and consistent water supply is readily available to the calves at all times. Automatic waterers or buckets with nipples can be used to provide water. Regularly check and clean water sources to ensure they are free from contaminants.
- **Feeding equipment:** Use appropriate feeding equipment such as individual feeding buckets or nipple bottles to provide milk or milk replacer to the calves. Keep the feeding equipment clean and sanitized to prevent the spread of diseases.
- **Solid feed access:** As the calves transition to solid feed, provide separate feeders or troughs for each calf to prevent competition and ensure access to feed.



Figure 7: Calf pen

Provide ventilation: Ventilation is critical for maintaining air quality, controlling temperature, and reducing humidity in the house. Ventilation in dairy cow housing can be categorized into natural ventilation and artificial ventilation, each with its own considerations and benefits. Artificial ventilation involves the use of mechanical systems, such as fans, to enhance or supplement natural airflow. Natural ventilation relies on the use of openings and air movement created by natural forces such as wind and door. Key points related to natural ventilation in dairy cow housing:

- The orientation of the cow house should consider prevailing wind directions to maximize natural airflow. Placing windows, doors, or vents strategically can facilitate the entry and exit of air.
- A ridge opening along the roof ridge allows warm air to rise and escape, promoting natural convection and air exchange. Proper design and placement of ridge openings enhance the effectiveness of natural ventilation.
- Adjustable side wall openings, such as windows or curtains, can be utilized to regulate airflow. These openings can be adjusted based on weather conditions, allowing for increased or decreased ventilation as needed.

Provide light: Lighting plays a crucial role in dairy cow housing, as it not only provides visibility but also affects cow behavior, productivity, and overall well-being. Natural lighting refers to the use of natural sunlight to illuminate the cow house. To optimize natural lighting and artificial lighting consider the following:

- Incorporate windows, skylights, or translucent panels in the cow house design to allow natural light to enter. Properly position these openings to ensure even distribution of light and minimize glare.
- Consider the orientation of the cow house concerning the sun's path to maximize the amount of natural light entering the building.
- Artificial lighting is used to supplement natural light, provide consistent illumination, and extend the lighting period during darker hours or in indoor facilities. Factors to consider for artificial lighting in a dairy house:
 - ✓ Provide sufficient lighting intensity to facilitate cow movement, feeding, and visual acuity. The recommended light intensity for dairy cows is typically around 150-200 lux (foot-candles) in the general area and higher (200-300 lux) in specific task areas like feed alleys.
 - ✓ Ensure even distribution of artificial light throughout the cow house to minimize shadows and dark areas. Properly positioned light fixtures and reflective surfaces can help achieve this.

Construct cow handling crush: The primary function of a cattle crush is to safely restrain and immobilize individual cattle during various procedures, such as vaccinations, deworming, hoof trimming, or veterinary examinations. There are different elaborate facilities to restrain animals such as chute, rope, crush, pen, *etc.* from these the common and easily affordable for our small scale farmers are cattle crush. The crush may be constructed of tubular metal, swan timber or roughly dressed timber. Tubular metal is the most satisfactory.

The common fault in designing of crushes is to provide too much room for the individual animal. When considering the dimensions of a cattle crush for tropical large dairy cattle, it's important to provide ample space for the animals to stand comfortably while considering their size and specific needs. General guidelines for the width, length, and height of a cattle crush for tropical large dairy cattle:

- **Width:** The width of the cattle crush should be wide enough to accommodate the size of tropical large dairy cattle breeds comfortably. A range of approximately 3 to 4 feet (0.9 to 1.2 meters) is often suitable.
- **Length:** The length of the cattle crush should be sufficient to accommodate the full body length of the tropical large dairy cattle breeds. A range of approximately 10 to 12 feet (3 to 3.7 meters) is commonly used.
- **Height:** The height of the cattle crush should provide adequate headroom for the tropical large dairy cattle breeds. A range of approximately 6.5 to 7.5 feet (2 to 2.3 meters) is typically suitable.



Figure 7: Cattle crush made from tubular metal

Designated manure storage area: Allocate a specific area on the farm for manure storage. This area should be well-drained and located away from water sources such as streams, wells, or sensitive environmental areas. The size of the storage area should be based on the herd size, manure production rate, and storage duration. Manure should be properly removed, stored, treated and utilized as fuel or fertilizer.



Figure 8: Manure storage pit



Figure 9: Manure cake for fuel

Practical activity-3	Identify dairy house facilities
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A. Resources required

- Appropriate personal protective equipment: This may include boots, overalls, gloves, and a hat.
- Checklist and pen: Take notes during your visit to record important details.
- Measuring tape: Carry a measuring tape to measure the dimensions of stalls, feeding troughs, and other relevant areas.

B. Procedures

1. Prepare checklist
2. Before visiting the farm, make sure you have appropriate personal protective equipments such as boots, overalls, gloves, and any other protective clothing required by the farm to maintain biosecurity protocols.
3. Walk through the cattle barns and housing areas. Take note of the overall layout, size, and design of the facilities. Assess if they can accommodate the number of cows intended for the space.
4. Measure the dimensions of the stalls, feed trough and water trough to ensure wither they are enough size or not.

5. Assess the flooring material used and its suitability for cow comfort and hygiene.
6. Observe the ventilation system in place, including fans, windows, or other air exchange mechanisms. Assess the lighting conditions within the cattle housing area to ensure they promote cow well-being and productivity.
7. Take note of any additional facilities such as a calving area, milking parlor, treatment area, or storage spaces for feed and supplies. Evaluate their organization, cleanliness, and functionality.
8. Document your observations by taking notes and photographs (if allowed by the farm). This will help you recall the details of the visit and compare different facilities later.

Self-check question -3	Written test
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Choice the correct answer from the given alternative

1. Which housing type for dairy cattle provides individual stalls for each cow?
 - A. Conventional house
 - B. A and B
 - C. Loose house
 - D. None of the above
2. Which housing type for dairy cattle includes open-sided or enclosed barns?
 - A. Conventional house
 - B. Loose house
 - C. a and b
 - D. None of the above
3. What is the recommended width of a feeding trough for dairy cows?
 - A. 30 to 45 centimeters
 - B. 60 to 75 centimeters
 - C. 90 to 120 centimeters
 - D. 2 to 2.5 meters
4. What is the primary purpose of a calving and maternity area in a dairy cow facility?
 - A. Providing a comfortable resting area for cows
 - B. Separating cows based on their milk production levels
 - C. Facilitating the birthing process and ensuring calf safety
 - D. Storing feed and supplies for the cows
5. What is the purpose of ventilation in a dairy cow housing facility?
 - A. Controlling temperature
 - B. Reducing humidity
 - C. Maintaining air quality
 - D. All of the above

Unit Summary

Establishing a successful dairy farm requires careful consideration of various factors. When selecting a site, it is important to choose a location with good market access, availability of utilities, proximity to veterinary services, and reliable transportation infrastructure. Assessing soil quality, drainage, and availability of pasture or forage resources is also crucial. The choice of production system depends on goals, available resources, and market demands. Intensive systems maximize milk production through controlled environments, while semi-intensive systems strike a balance between grazing and confinement. Extensive systems emphasize grazing and rely heavily on pasture. Constructing suitable housing facilities for the dairy cows is essential, ensuring adequate space, proper ventilation, insulation, clean resting areas, and easy access to feed and water. Careful consideration of these requirements will help establish a dairy farm that meets the specific needs of the operation and local regulations.

Unit Review Questions

Choose the correct answer from the following alternative letters

1. Which of the following factors is not a critical consideration when selecting a site for a dairy farm?

- | | |
|-----------------------------------|-------------------------------------|
| A. Proximity to residential areas | C. Distance from recreational area |
| B. Availability of grazing land | D. Soil texture for crop production |

2. Why is water availability important for a dairy farm?

- | | |
|---------------------------------------|----------------------------|
| A. To maximize milk production | C. To irrigate forage land |
| B. To provide drinking water for cows | D. All of the above |

3. Which of the following is an essential consideration for housing facilities in a dairy farm?

- | | |
|--------------------------------------|--|
| A. Adequate airflow and ventilation. | C. Comfortable resting areas for cows. |
| B. Access to clean and fresh water. | D. All of the above. |

4. Which of the following is an economic benefit of dairy cattle production?

- | | |
|-------------------------------------|----------------------|
| A. Employment and income generation | C. Fish farming |
| B. Crop production for grain | D. Mining operations |

5. What is the recommended length of a dairy cow stall?

- | | |
|--------------------------------------|------------------------------------|
| A. 1.2 to 1.4 meters (4 to 4.5 feet) | B. 1.2 to 1.5 meters (4 to 5 feet) |
|--------------------------------------|------------------------------------|

- C. 2.4 to 2.7 meters (8 to 9 feet) D. 2 to 2.5 meters (6.5 to 8 feet)
6. What is the recommended length of a water trough for a single dairy cow?
- A. 30 to 45 centimeters (12 to 18 inches) C. 90 to 120 centimeters (36 to 48 inches)
- B. 60 to 75 centimeters (24 to 30 inches) D. 2 to 2.5 meters (6.5 to 8 feet)

Answer key for self-check questions

Self-check question -1

1. Climate, Topography, Water Availability, Feed Resources, Land Availability and Suitability, Proximity to Markets
2. Between 4°C and 24°C

Self-check question -2

1. The economic importance of dairy cattle production refers to the significant role that this sector plays in a country's economy.
2. Milk production, job opportunity, livestock sales and community support

Self-check question -3

1. A 2. B 3. B 4. C 5. D

Project Work

LAP TEST 1

Site selection and identifying dairy cattle housing facilities

Instructions: Visit one model dairy farm and given necessary templates, tools and materials you are required to perform the following tasks within **1** hour.

Task-1. Decide while the dairy site you visited suitable for dairy farm or not based on the site selection criteria

Task-2. Identify and write dairy cattle housing facilities that found in the model farm you have visited

UNIT 2

Dairy Cattle Feeding

Learning outcomes

At the end of this unit, the students will be able to

- Identify dairy cattle feed sources
- Undertake feeding strategies for dairy cattle

Key Terms:

- Concentrates
- Roughage

Unit Introduction

Mention the feed sources for dairy cattle? How to provide feed for dairy cattle?

The obtaining of suitable feed sources and the implementation of an effective feeding strategy are crucial for meeting the nutritional requirements of dairy cattle, optimizing milk production, and ensuring the overall health and productivity of the herd. Feed can be categorized into two roughage and concentrate. Roughage feed includes cultivated forages, natural grazing pasture, hay, silage and crop residues. While concentrate feed ingredients are industrial by-products, grains (corn, millet, wheat, barley, cottonseed meal, soybean meal, groundnuts, flaxseed, and sunflower seeds). Concentrate feed can further group into protein supplement and energy supplement.

Developing a feeding strategy involves formulating a balanced ration that meets the specific nutritional requirements of the dairy cattle. Factors such as the stage of lactation, cow body condition, and production goals must be considered. The ratio of forages to concentrates; feeding frequency, feed mixing, and delivery methods are key aspects of a well-designed feeding strategy.

2.1. Dairy Cattle Feed Sources

Dairy cattle require a balanced diet that meets their nutritional needs for milk production, growth, and maintenance. The feed sources for dairy cattle can be divided into two main categories: roughage and concentrates.

A. Roughage feed sources

Roughage feed refers to feed sources that are high in fiber and provide bulk to the diet of animals, particularly ruminant animals like cattle. Roughage is also known as forage or fiber feed. It includes various plant materials that are consumed by animals for their fibrous content and contribute to maintaining a healthy digestive system.

In Ethiopia, various roughage feed sources are commonly used for dairy cattle. These include cultivated forages, natural grazing pasture, hay, silage, and crop residues.

- **Cultivated forages:** These are specific forage crops that farmers grow intentionally to feed their dairy cattle. Cultivated forages are cultivated in fields and include grasses, legumes, or other plant species that are rich in nutrients and suitable for animal consumption.
- **Natural grazing pasture:** Natural grazing pastures refer to areas of land where dairy cattle are allowed to freely graze on native grasses and legumes. These pastures are not cultivated but consist of naturally occurring vegetation that provides forage for the cattle.
- **Hay:** Hay is commonly used roughage feed source in Ethiopia. It involves cutting and drying grasses or legumes, such as Rhodes grass, alfalfa, or clover, to reduce moisture content. The dried forage is then stored and used as feed during periods when fresh forage is limited, such as the dry season.
- **Silage:** Silage is fermented forage made from crops like maize (corn), grasses, or legumes. It is harvested at high moisture content, chopped into small pieces, packed tightly, and stored in airtight conditions.
- **Crop residues:** Crop residues are the leftover stalks, leaves, and stems of crops after the grain or seed has been harvested. In Ethiopia, common crop residues used as roughage feed sources for dairy cattle include wheat straw, *teff* straw, barley straw, maize stover, sorghum Stover and legume crop residues. These residues are collected and utilized as a source of feed, especially during the dry season when fresh forage is limited.

B. Concentrate feed sources

The term "concentrate" signifies that these feeds are dense in nutrients, allowing animals to obtain a greater amount of essential nutrients in a smaller volume of feed. This is particularly important when the animal's nutritional needs are not being adequately met through the available roughage sources or when there is a need to optimize production performance, such as during periods of high milk production. In Ethiopia, some commonly used industrial byproduct feeds for dairy cattle include:

- **Brewers' grains:** Brewers' grains are a popular byproduct feed for dairy cattle. They are obtained from the brewing industry and provide a good source of protein, fiber, and energy.
- **Wheat bran:** Wheat bran, a byproduct of wheat milling, is readily available in Ethiopia and is commonly used as a concentrate feed. It is high in fiber and can contribute to the energy content of the diet.
- **Oilseed cakes and meals:** Byproducts from oilseeds, such as soybean meal, cottonseed meal, and rapeseed meal, are valuable protein sources for dairy cattle. They provide essential amino acids and can help meet the protein requirements of the animals.
- **Distillers' grains:** Distillers' grains, a byproduct of ethanol production, can be used as a feed source for dairy cattle. They are derived from grains like maize (corn) and are rich in protein, fiber, and residual fat.
- **Molasses:** Molasses, a byproduct of sugar refining, is commonly used as an energy supplement for dairy cattle. It is a concentrated source of carbohydrates and can enhance the palatability of the feed.

Self- check question -4	Written test
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Write the correct answers for the following questions

1. List at least 5 a crop residue commonly used as a feed source for dairy cows.
2. List at least 5 agro-industrial by-products?

Practical activity-3	Identify feed sources for dairy cattle
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A. Resources required

- Checklist
- Data from local agricultural office
- Local feed suppliers
- local agricultural extension services

B. Procedure

1. Prepare checklist
2. Contact your local agricultural office or government agricultural department to obtain information on the crops grown in that area, potential agro industrial by-products and crop residues available as feed sources.
3. Reach out to local feed suppliers and inquire about the feed ingredients they offer. Ask for information on the nutritional composition, availability, and prices of different feed sources they provide.
4. Contact your local agricultural extension services or agricultural universities. Seek guidance from agricultural extension officers who can provide valuable insights on available feed sources and their suitability for dairy cattle.
5. Compile the data obtained from the agricultural office, feed suppliers, and agricultural extension services.

2.2. Feeding Strategies of Dairy Cattle

Feeding dairy cattle is crucial for their health and productivity. Effective feeding strategies involve providing a balanced diet, utilizing methods like mixed ration and grazing, ensuring feed quality, and monitoring cow performance. These strategies optimize nutrition, maximize milk production, and support overall herd well-being. Methods that commonly used in dairy cattle feeding strategies are grazing, carry and cutting system and feeding formulated ration.

1. Grazing

Grazing is allowing dairy cattle to graze on well-managed pastures as a natural and cost-effective feeding method. It provides fresh forage, promotes exercise, and contributes to cow health and productivity.

2. Cut-and-Carry system

In this method, forage crops such as grasses, legumes, or corn are grown and harvested to be fed to the cows. The forage is cut, dried, and stored as hay or ensiled as silage. This method allows for more precise control over the quantity and quality of feed provided to the cows.

3. Ration formulation

Ration formulation is the process of developing a balanced and nutritious diet for livestock, including dairy cattle, by combining different feed ingredients in appropriate proportions. It involves considering the nutritional requirements of the animals and the availability of various feed sources. Feed bunks or troughs are used to deliver the mixed feed to the cows. Feed bunks or troughs allows for easy access to feed and minimizes feed wastage. General guidelines for formulating a dairy cow ration include:

A. Identifying nutrient composition of feeds

Nutrient composition refers to the quantitative measurement and description of the nutrients present in various types of feed ingredients used in animal nutrition. Nutrients are essential substances that provide energy, support growth, and maintain overall health in animals. The nutrient composition of feeds includes information on the levels of key nutrients such as protein, fiber, carbohydrates, fats, vitamins, minerals, and energy content. These nutrients play vital roles in the animal's metabolism, growth, reproduction, and overall performance.

Table 1. Nutrient composition different feeds

Feed ingredient	Protein (%)	Energy (TDN) (%)	Fiber (%)	Calcium (%)	Phosphorus (%)
Oil seed cake	30-50	60-70	10-30	0.5-2	0.5-1.5
Brewery by-product	20-30	45-55	20-40	0.1-0.5	0.3-0.8
Wheat bran	13-18	55-65	10-20	0.1-0.2	0.4-0.6
Molasses	<5	75-85	Negligible	0.1-0.2	0.05-0.1
Forage (e.g., Alfalfa hay)	15-20	55-65	25-40	0.3-1.5	0.1-0.5
Wheat straw	3-10	40-50	30-40	0.2-0.5	0.2-0.5
Barley straw	3-10	40-50	30-40	0.2-0.5	0.2-0.5
Teff straw	5-15	45-55	25-35	0.3-0.8	0.2-0.6

B. Nutritional requirements of the dairy cattle

Meeting the nutritional needs of dairy cattle involves providing a balanced diet that includes the right amounts of energy, protein, fiber, vitamins, minerals, and water. These nutrients support various physiological processes, such as milk synthesis, tissue repair and growth, immune function, and overall metabolic function. The nutritional requirements of dairy cattle can vary depending on factors such as age,

weight, stage of lactation, milk production level, and breed. It is important to consider these factors when formulating a diet for dairy cattle to ensure optimal health and performance.

Table 2. Nutritional requirements of the dairy cattle

Nutrient	Calves (%)	Heifers (%)	Lactating Cows (%)	Dry cows (%)	Pregnant Cows (%)
Energy (Total digestible nutrients)	70-75	65-70	55-65	50-55	50-60
Crude protein	18-20	16-18	16-18	12-14	12-14
Fiber	20-25	20-25	18-22	22-25	22-25
Calcium	0.8-1.2	0.8-1.0	1.0-1.2	0.8-1.0	0.8-1.0
Phosphorus	0.4-0.5	0.35-0.45	0.35-0.45	0.25-0.35	0.25-0.35
Mineral and vitamin premix inclusion	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0

C. Determining the roughage-to-concentrate ratio

Determining the roughage-to-concentrate ratio for dairy cattle involves establishing the appropriate balance between roughage (fiber-rich feeds) and concentrates (energy-dense feeds) in the animals' diet. The specific ratio depends on several factors, including the type of livestock, their nutritional requirements, the desired rate of milk production, and available feed resources.

Table 3. Roughage-to-concentrate ratio.

Category	Roughage-to-Concentrate Ratio
Calf	70:30 to 50:50
Heifer	60:40 to 70:30
Lactating Cow	40:60 to 60:40
Dry Cow	70:30 to 80:20
Pregnant Cow	70:30 to 80:20

D. Calculating the total feed daily intake

To calculate the total dry matter intake (DMI) for different categories of dairy cattle, including calves, heifers, dry cows, and pregnant cow, lactating cows, you need to consider their body weight, milk production and specific growth or physiological stages. Here's a general approach to estimating the dry matter intake for each category:

Calves: Estimate the DMI based on a percentage of the body weight. For example, a common range for calves is 2.5% to 4% of their body weight.

Heifers: Estimate the DMI based on a percentage of the body weight. For heifers, the range is typically 2% to 3% of their body weight.

Dry cows: Estimate the DMI based on a percentage of the body weight. Dry cows generally require less feed, and the range is typically 2% to 2.5% of their body weight.

Pregnant cows: Estimate the DMI based on a percentage of the body weight. Pregnant cows have increased nutrient requirements, and the range is typically 2.5% to 3% of their body weight.

Generally, the formula used to calculate the total dry matter intake for calves, heifer, dry cow and pregnant cow is: Total Feed Intake = Body Weight x Dry Matter Intake Percentage

Example: Let's assume we have a heifer with a body weight of 400 kg and a dry matter intake percentage of 2.5%. Calculate total dry matter intake per day?

$$\text{Total Feed Intake} = 400 \text{ kg} \times 0.025 = 10 \text{ kg/day}$$

Based on this example, the estimated total feed intake for the heifer would be 10 kg per day.

Lactating cows: To estimate the DMI for lactating cows, you can use the NRC model or other established guidelines. Here's a general approach using the NRC (National Research Council) model:

$$\text{DMI (kg/day)} = (a * \text{BW}^{0.75}) + (b * \text{MP})$$

The coefficients 'a' and 'b' in the equation depend on the stage of lactation. The NRC provides different sets of coefficients for early lactation, mid-lactation, and late lactation. You can choose the appropriate set of coefficients based on the stage of lactation for your cows.

Table 4. Coefficients for early lactation, mid-lactation, and late lactation

Stage of Lactation	Coefficient 'a'	Coefficient 'b'
Early Lactation	0.03 - 0.04	0.70 - 0.90
Mid-Lactation	0.03 - 0.05	0.90 - 1.00
Late Lactation	0.02 - 0.03	0.90 - 1.00

Example: Let's assume we have a lactating cow with a body weight (BW) of 600 kg and a milk production (MP) of 25 kg/day.

$$a = 0.03 \quad b = 0.75$$

Substituting the values into the equation:

$$\text{DMI} = (0.03 * 600^{0.75}) + (0.75 * 25)$$

$$\text{DMI} = (0.03 * 91.65) + 18.75$$

$$\text{DMI} = 2.75 + 18.75$$

$$\text{DMI} = 21.5 \text{ kg/day}$$

Based on this example, the estimated dry matter intake for the lactating cow would be 21.5 kg per day.

E. Formulating ration and providing for the animals

Ration formulation is the process of developing a balanced diet for animals by determining the appropriate proportions of various feed ingredients to meet their specific nutritional requirements. It involves considering the nutrient composition of available feed ingredients and formulating a diet that provides the necessary amounts of energy, protein, fiber, vitamins, minerals, and other essential nutrients. This involves calculating the appropriate proportions of each ingredient to achieve the desired nutrient levels. The goal is to provide adequate energy, protein, and other nutrients while minimizing nutrient imbalances or deficiencies. Here are the methods commonly used in ration formulation:

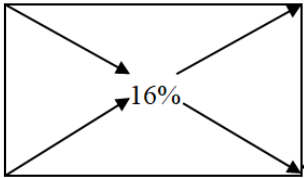
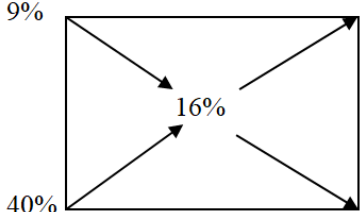
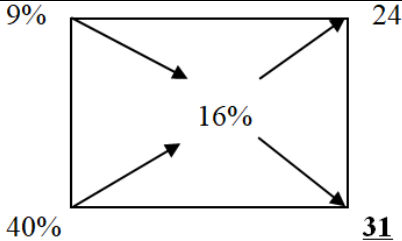
i. Pearson Square Method

This method involves using a simple balancing technique with two feed ingredients. By comparing the nutrient content of each ingredient and the desired nutrient levels, you can calculate the proportions needed to achieve the desired balance. This can be represented algebraically as an equation or a system of equations.

Example: - A sheep producer wants to formulate a concentrate supplement that provides 16% Crude protein. He has shelled corn (9% CP) and cottonseed cake (40% CP). What combination of the shelled corn and cottonseed cake will provide a mix of 16% CP the producer wants?

Solution; - See the following table to calculate step by step carefully.

Table 5. Pearson Square method of ration formulation

Step 1	Draw a square and write CP% desired in the final mixture (16) in the middle of the square that represents the nutritional requirement of the animal.	
Step 2	Write the two numbers on the left that represent the feedstuffs (ingredients) CP (9%) and CP (40%) shelled corn and cottonseed cake respectively used to make the ration. The number in the middle of the square must fall between the numbers on the left.	
Step 3	Subtract the nutrient value on the left from the nutritional requirement in the middle disregarding any negative and Add the feedstuff parts together (those results).	
Step 4	Divide the ingredient for which you want to know the ration by the total parts. Multiply by 100 to determine the percentage. Round if necessary.	$24/31 \times 100 = 77.4\%$ Corn $7/31 \times 100 = 22.6\%$ CSC

Step 5	To determine the amount of each feed ingredient, multiply the percentage of each ingredient by the total amount of feed desired.	$77.4\% \times 100\text{kg}/100 = 77.4\text{kg}$ $22.6\% \times 100\text{kg}/100 = 22.6\text{kg}$
Step 6	Check whether the final mix really contains the desired Crude Protein (CP) level by calculating the contributions of the ingredients constituting the mixture (corn and CS cake) and summing up.	$(9 \times 77.4)/100 = 7$ Contribution of corn $(40 \times 22.6)/100 = 9$ Contribution of CSC Total CP % = $7 + 9 = 16\%$

ii. Trial and Error Method

This method involves formulating a ration based on estimated nutrient requirements and then adjusting the amounts of feed ingredients based on observed animal performance. Algebraically, this can involve creating a system of equations where the nutrient composition of the ration is adjusted until the desired performance is achieved.

iii. Algebraic methods

Algebraic methods can be used in ration formulation to mathematically represent the relationships between nutrient requirements and feed ingredient composition. Assign variables to represent the quantities or proportions of feed ingredients in the ration. Commonly used variables are 'x', 'y', 'z', and so on. For example, 'x' could represent the proportion of Feed Ingredient A; 'y' could represent the proportion of Feed Ingredient B, and so on. The specific variables used depend on the number of feed ingredients and their proportions in the ration.

iv. Using software

These software programs use mathematical models and algorithms to formulate rations that meet nutrient requirements and optimize objectives such as cost minimization or production maximization.

Generally, it is important to note that ration formulation is a complex process that requires expertise in animal nutrition. It's advisable to consult with an animal nutritionist, veterinarian, or other qualified professionals who can provide guidance to optimize the ration formulation process.

Self-check question -5	Written test
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Match the description under column A with its feeding method under column B

No	<u>A</u>	Answers	<u>B</u>
1	Allowing dairy cattle to graze on well-managed pastures		A. Trough Feeding
2	Forage crops are grown and harvested to be fed to the cows		B. Cut-and-Carry System
3	Method that allows for easy access to feed and minimizes feed wastage		C. Grazing

Unit Summary

Identifying suitable feed sources and implementing effective feeding strategies are essential elements of comprehensive dairy cattle management. Dairy cattle require a balanced diet consisting of both roughage and concentrate feeds to meet their complex nutritional needs. Roughage sources, such as hay, silage, and pasture, provide the necessary fiber to maintain rumen health and functionality. Concentrates, including grains and protein supplements, supply additional nutrients to support high milk production.

Dairy farmers employ various feeding methods to deliver this optimal mix of forages and concentrates to their herds. Grazing systems allow cows to self-select and consume fresh pasture, while cut-and-carry systems involve harvesting and transporting forage directly to feeding troughs. Trough feeding, on the other hand, involves providing a thoroughly mixed ration of roughage and concentrates in designated feeding areas.

Unit Review Questions

1. Which of the following is roughage feed source commonly used for dairy cattle?

- A. Soybean meal
- B. Wheat bran
- C. Brewers' grains
- D. Alfalfa hay

2. What is the purpose of roughage in the diet of dairy cattle?

- A. To provide essential amino acids
- B. To enhance palatability
- C. To meet energy requirements
- D. To provide bulk and maintain a healthy digestive system

3. Which of the following is a concentrate feed source for dairy cattle?

- A. Maize silage
- B. Natural grazing pasture
- C. Distillers' grains
- D. Wheat straw

4. What is the main nutrient provided by oilseed cakes and meals in dairy cattle diets?

- A. Fiber
- B. Carbohydrates
- C. Protein
- D. Minerals

5. Which feed source is commonly used as an energy supplement for dairy cattle?

- A. Molasses
- B. Silage
- C. Teff straw
- D. Sorghum stover

6. Which feeding method involves allowing dairy cattle to graze on well-managed pastures?

- A. Total Mixed Ration
- B. Cut-and-Carry system
- C. Trough feeding
- D. Grazing

7. What does the cut-and-carry system involve?

- A. Feeding dairy cattle a mixed ration in troughs
- B. Grazing cattle on well-managed pastures
- C. Harvesting forage crops and feeding them to cows
- D. Providing fresh forage to cows on a daily basis

8. Ration formulation for dairy cows involves:

- | | |
|---------------------------------------|--------------------------|
| A. Balancing nutritional requirements | C. Rotational grazing |
| B. Monitoring cow performance | D. Ensiling forage crops |

Answer key for self-check questions

Self-check question -4

1. Wheat straw, barley straw, maize stover, teff straw and legume crop residues
2. Wheat bran, Oils seed cake, brewery by product, molasses and distiller's grains

Self-check question -5

- | | | |
|------|------|------|
| 1. C | 2. B | 3. A |
|------|------|------|

Project Work

LAP TEST2	Identifying feed sources and feeding strategies
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Instructions: Visit one model dairy farm and given necessary templates, tools and materials you are required to perform the following tasks within 5 hour. The project is expected from each student to do it.

Task-1. Identify and write the feed sources found around the farm

Task-2. Perform the feeding strategies that applicable in the model farm

UNIT 3

Dairy Cattle Management Practices

Learning outcomes

At the end of this unit, the students will be able to

- Score body condition
- Trim hoof
- Under take identification methods
- Manage new born calf
- Keep record
- Manage heifer
- Manage dairy cow
- Maintain hygiene and health

Key Terms

- Body condition
- Dry cow
- Heifer
- Hygiene
- Lactating cow
- Pregnant cow

Unit Introduction

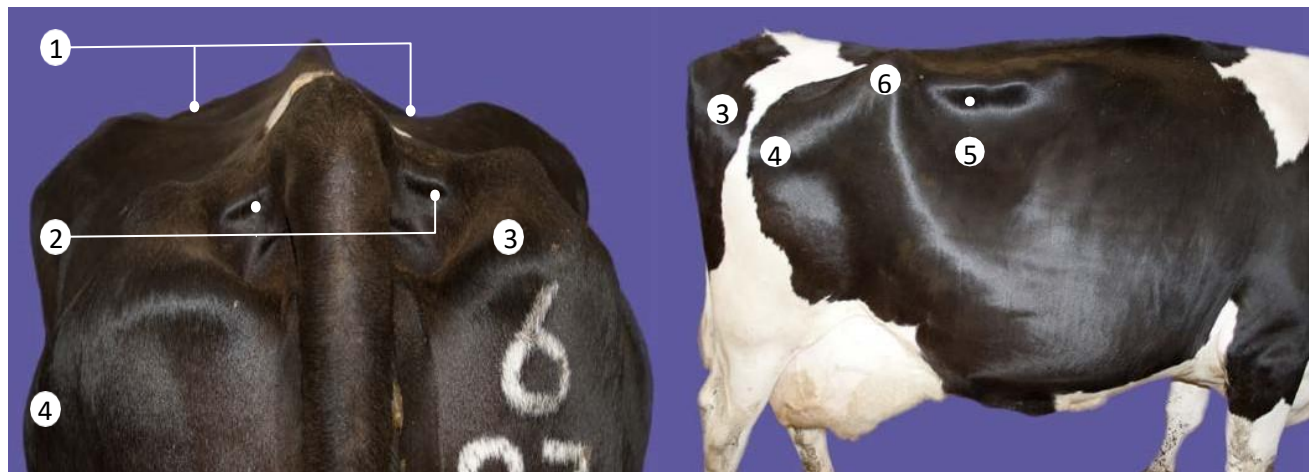
What are the aims of proper dairy cattle management? Mention some of the dairy cattle management practices?

Dairy cattle management encompasses various key aspects aimed at ensuring the health, welfare, and productivity of dairy cows. These management activities involve providing care for newborn by monitoring their health and ensuring proper nutrition during their critical early stages of life. Heifer management

focuses on the care and development of young female cattle before they reach reproductive age, including providing appropriate nutrition, monitoring health, and preparing them for future milk production. Managing mature cows involves aspects such as providing a balanced diet, monitoring their health conditions, implementing reproductive management strategies, and maintaining proper housing and environmental conditions. Ensuring hygiene and health are properly maintained is crucial to prevent disease, promote cow comfort, and optimize milk production.

3.1. Body Condition Scoring


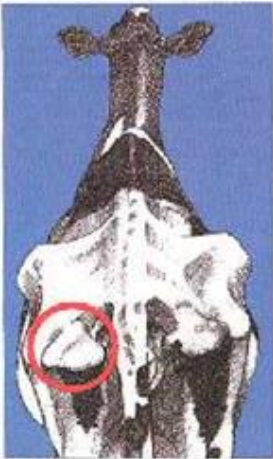
Body condition scoring (BCS) is a valuable tool in dairy cow management that allows farmers to assess the body condition or fat reserves of their cows. It involves assigning a numerical value to indicate the level of fat deposition or body condition in cows. The BCS scale typically ranges from 1 to 5, with each value representing a different level of body condition. It performed visually and tactically evaluating specific body areas to determine the amount of fat cover or prominence of bones and muscles. This assessment provides important information about the cow's nutritional status, reproductive performance, and overall health. The ideal body condition range generally falls around 3 to 3.5 on a 5-point scale. Cows within this range are considered to have optimal fat cover for reproduction, milk production, and overall health. The following indicate the body parts that used to score body condition.







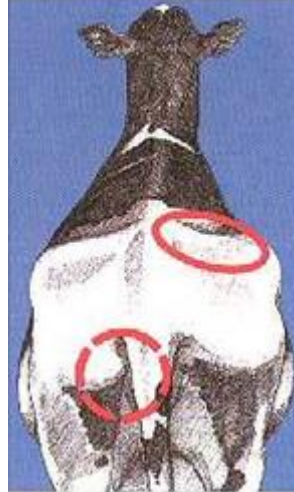
1. Sacral ligament 2. Tail head ligament 3. Pins 4. Thurl 5. Short ribs 6. Hooks

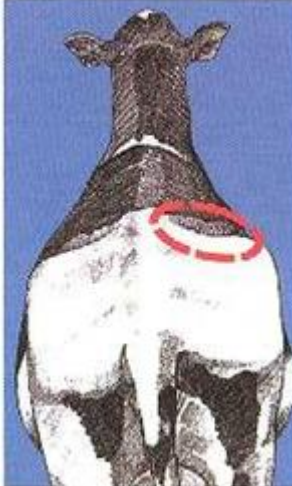
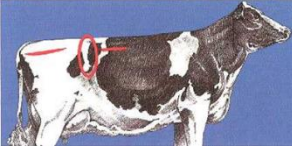
Figure 10: External body parts of dairy cow that used for body condition score

Table 6. Body condition scoring scale

Body condition scoring scale	Image
<p>If no fat pad on pins BCS<2.50. View the short ribs. Look for corrugations (visible ridges) along the top of short ribs as fat covering disappears. If corrugations visible 1/2 way between tip and spine of short ribs, BCS=2.25. If corrugations visible ¾ way from tip to spine BCS=2.0. If thurl prominent and saw-toothed spine BCS < 2.0.</p> <p>When a cow has a body condition scores (BCS) of less than 2.50, it typically indicates that the cow is under conditioned or relatively thin.</p> <p>An under conditioned cow with a BCS below 2.50 may exhibit visible or easily palpable short ribs and a more angular appearance in the thurl region.</p>	
<p>If pins angular BCS<2.75. If palpable fat pad on point of pins BCS = 2.50.</p> <p>In the context of a BCS range of 2.50 up to BCS<2.75, the pin bones or hooks may still be visible to some extent. However, they are likely to be less prominent compared to cows with lower BCS values.</p>	

<p>If hooks angular BCS\leq2.75.</p> <p>If the hooks (hip bones) of a cow appear angular and the body condition score (BCS) is less than or equal to 2.75, it indicates that the cow is still under conditioned but is in the process of improving its body condition. The hooks, which are the hip bones of the cow, may still be visible and have a relatively sharp or angular appearance. This suggests that there is minimal fat cover over the hip bones.</p>	
<p>If the line forms a flattened V then BCS\leq3.0.</p> <p>If the line formed by the back of a dairy cow forms a flattened V shape, it suggests that the cow likely has a lower Body Condition Score (BCS) of 3.0 or less. A flattened V shape typically indicates a reduced fat cover along the back and loin area of the cow.</p>	
<p>If hooks rounded BCS=3.0.</p> <p>If the hooks (i.e., the prominent points of the cow's hip bones) appear rounded, it suggests that the cow has a Body Condition Score (BCS) of 3.0. In the Body Condition Scoring system, a BCS of 3.0 typically represents a moderate body condition, indicating a moderate amount of body fat.</p> <p>The hooks, or hip bones, are palpable but not overly prominent. They have a rounded appearance, indicating a moderate amount of fat cover in that area. The ribs can be felt with slight pressure but are not prominently visible. They are covered by a moderate layer of flesh.</p>	
<p>If the line forms a crescent or flattened U consider BCS\geq3.25.</p> <p>If the line formed by the cow's back and hooks (hip bones) appears like a crescent or flattened U shape, it suggests that the cow's body condition score</p>	

<p>(BCS) is equal to or greater than 3.25. Here's what you may observe in such a situation:</p> <p>The cow will have a significant amount of fat cover over the backbone, ribs, and other parts of the body. The ribs will be well-covered, and there will be ample fat deposited over the hooks, resulting in a rounded and smooth appearance.</p> <p>The cow's body shape will appear rounded and full. The fat cover will contribute to an overall rounded contour, creating a crescent or flattened U shape along the back and hooks. The cow will have a plump and well-conditioned appearance.</p>	
<p>If sacral ligament visible and tail head ligament barely visible BCS=3.50.</p> <p>The sacral ligament, which runs along the spine near the tail head, is visible. This suggests a moderate to limited fat cover over the area, making the ligament noticeable.</p> <p>The ligament at the base of the tail, known as the tail head ligament, is barely visible.</p>	

<p>If sacral ligament barely visible and tail head ligament not visible BCA=3.75. If sacral and tail head ligament not visible BCS\geq4.0.</p> <p>The sacral ligament, which runs along the spine near the tail head, is barely visible, indicating a moderate fat cover in that area.</p> <p>The ligament at the base of the tail, known as the tail head ligament, is not visible, suggesting a good fat cover over the tail head region.</p> <p>The cow will have a moderate to good fat cover over the backbone, ribs, hooks, and pins, resulting in a rounded and smooth body shape.</p> <p>There will be a balanced distribution of fat and muscle, with moderate to good muscle development and tone throughout the body.</p>	
<p>If thurl flat BCS$>$4.0. If tip of short ribs barely visible BCS=4.25. If thurl flat and pins buried BCS=4.5. If hooks barely visible BCS=4.75. If all bony prominences well rounded BCS=5.0. Cows with a BCS of 5 will have a generous fat cover over the backbone, ribs, hooks, pins, and other areas of the body. The ribs will be well-covered, and there will be ample fat deposition, resulting in a plump and rounded appearance.</p>	

Practical activity-6	Perform body condition scoring
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A. Resources required

- Checklist and pen: This allows to keep track of individual cow scores over time and monitor changes in body condition
- Chute or crush: Chute or crush is necessary to restrain and observe cows during the scoring process.
- Gloves: Wearing gloves is essential to maintain hygiene and prevent the transfer of pathogens while palpating the cow's body areas. This helps minimize the risk of spreading diseases between animals.

B. Procedures

1. Prepare checklist
2. Begin by visually inspecting the cow from a distance. Look for overall body shape, angularity, and obvious signs of fat cover or lack of fat cover.
3. Approach the cow and stand on its left side for consistency.
4. Start assessing the cow's BCS by evaluating the short ribs:
 - ✓ Look for the presence of a fat pad on the pins (hip bones). If there is no fat pad, the BCS is less than 2.50, indicating the cow is relatively thin.
 - ✓ Examine the top of the short ribs. If corrugations (visible ridges or indentations) are present halfway between the tip and spine of the short ribs, the BCS is 2.25. If the corrugations are visible three-quarters of the way from the tip to the spine, the BCS is 2.0.
 - ✓ If the thurl (area around the hip joint) is prominent and the spine feels saw-toothed, the BCS is less than 2.0.
5. Move on to assess the pin bones (hooks):
 - If the pins appear angular, the BCS is less than 2.75.
 - If there is a palpable fat pad on the point of the pins, the BCS is 2.50.
6. Evaluate the hooks (hip bones):

- If the hooks appear angular and the BCS is less than or equal to 2.75, it indicates the cow is under conditioned but improving.

7. Observe the line formed by the cow's back:

- If the line forms a flattened V shape, the BCS is 3.0 or less, indicating reduced fat cover along the back and loin area.
- If the hooks appear rounded, the BCS is 3.0, representing a moderate body condition.

8. Assess the line formed by the back and hooks:

- If the line forms a crescent or flattened U shape, the BCS is equal to or greater than 3.25, indicating a well-conditioned cow with ample fat cover.

9. Examine the visibility of the sacral ligament and tail head ligament:

- If the sacral ligament is visible and the tail head ligament is barely visible, the BCS is 3.50.
- If both ligaments are not visible, the BCS is 3.75 or greater.

10. Evaluate the visibility of the tip of the short ribs and the thurl:

- If the tip of the short ribs is barely visible, the BCS is 4.25.
- If the thurl is flat and the pins are buried, the BCS is 4.5.
- If the hooks are barely visible, the BCS is 4.75.
- If all bony prominences, including the backbone, ribs, hooks, and pins, appear well-rounded, the BCS is 5.0, indicating generous fat cover.

Self-check question -6	Written test
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Match the description under column **A** with its BCS scale under column **B**

A	Answers	B
1. If no fat pad on pins, what is the BCS?		A. BCS=6
2. If sacral ligament visible and tail head ligament barely visible, what is the BCS?		B. BCS = 3.50

A	Answers	B
3. Ideal body condition		C. BCS = 3 to 3.5
4. If thurl flat and pins buried, what is the BCS?		D. BCS = 4.5
		E. BCS < 2.50

3.2. Hoof Trimming

Hoof trimming for dairy cows refers to the regular maintenance and care of the cows' hooves. It involves the trimming and shaping of the hooves to prevent overgrowth, address hoof-related issues, and promote hoof health. Hoof trimming is performed by professional hoof trimmers who use specialized tools to inspect, trim, and maintain the hooves. It helps prevent lameness, improve cow comfort, and maintain the overall well-being and productivity of dairy cows.

The desired length to cut excess hoof can vary depending on factors such as the cow's hoof condition, balance, and the recommendations of the hoof trimmer. However, as a general guideline, hoof trimmers often aim to achieve a hoof wall length of approximately 3/8 to 1/2 inch (9-12 mm) beyond the sole of the hoof. The average length of the hoof for dairy cattle can vary depending on factors such as breed, management practices, and individual variations. However, as a general guideline, the length of the hoof in dairy cattle should typically be around 2.5 to 3 inches (6 to 7.5 centimeters). If the length of the hooves in dairy cattle exceeds the average range of 2.5 to 3 inches (6 to 7.5 centimeters), it may indicate the need for corrective actions.

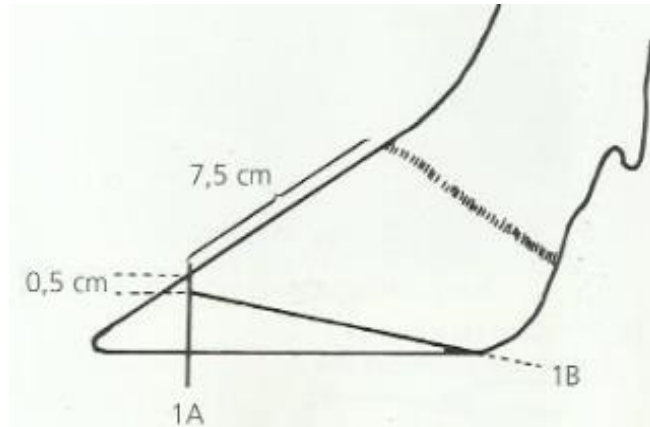


Figure 13: The average length of the hoof and the excess part



Figure 14: Restraining cow for hoof trimming



Figure 15: Hoof trimmer



Figure 16: Hoof cutter (Hoof nippers)

Practical activity-7	Perform hoof trimming
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A. Resources required

- Hoof cutter: To cut the excess hoof at desired length
- Hoof trimmer: A specialized knife with a sharp, curved blade used for trimming excess hoof after cutting and shaping it.
- Hoof stand or hoof block: A device or block used to support the cow's hoof during trimming, providing stability and easy access for the trimmer.
- Crush or chute; Used to restrain cows during hoof trimming
- Hoof Gauge or meter: A measuring device specifically designed for measuring hoof length and ensuring consistency in trimming.
- Marker or chalk: Used for marking or highlighting specific areas on the hoof to guide the trimming process.

B. Procedures

1. Secure the cow in a chute or restraint area that provides safety and control during the trimming process.
2. Clean the hooves thoroughly to remove dirt, debris, and manure. This allows for better visibility and accuracy during trimming.
3. Measure the desired length for trimming. This is typically 9-12 mm beyond the sole of the hoof, but it can vary based on the cow's hoof condition and the recommendations of the hoof trimmer. Use a measuring tool, such as a hoof gauge, against the base of the hoof wall to determine the desired length for trimming.
4. Mark the point on the hoof where the excess hoof material will be trimmed to using a marker or by making a small indentation.
5. Lift one hind leg at a time, supporting it with a hoof stand or block.
6. Use a hoof cutter and cut the excess hoof up to the marked point
7. Use trimmer and trim remaining excess hoof for shaping the hooves. You can use a hoof rasp or grinder to smooth the trimmed surfaces, removing any sharp edges or rough areas if you get the grinder
8. Proceed to cut and trim the front hooves following the same steps as for the hind hooves.

Self-check question -7

Written test

Write the correct answer for the following questions

1. Write 2 (two) main materials used for hoof trimming
2. As a general guideline, hoof trimmers person often aims to achieve a hoof wall length of approximately _____beyond the sole of the hoof.

3.3. Identification

Identification is the process of uniquely identifying individual cows in a herd. Accurate identification is crucial for several reasons, including evaluating individual cow performance, monitoring health and disease control, managing breeding programs, and ensuring accurate record-keeping. Some common methods used for dairy cow identification are ear tags, ear notching, neck chain and tattoos: Ear tagging is a common method used for identifying cows. It involves attaching small tags to the ear of a cow by ear tag applicator to provide a unique identification number or other relevant information.







Figure 17: Ear tag applicator

Figure 18: Ear tag

Figure 19: Ear tag inserted into applicator

Table 7. Dairy cattle identification methods

Identification methods	Description	Image
Ear tags	Plastic or metal tags that are attached to the cow's ear. Each tag has a unique number or code assigned to the cow for identification purposes. Ear tags are easily visible and can be read from a distance. They are widely used due to their cost-effectiveness and ease of application.	
Ear notching	It involves making small notches or cuts in the cow's ear using specific patterns to represent unique identification codes. Each notch pattern corresponds to a specific number or code. Ear notching is a visual identification method that requires close inspection of the cow's ears. It is a low-cost method but may be less commonly used due to its limitations in readability from a distance.	

Identification methods	Description	Image
Tattoos	Unique numbers or codes are tattooed on the cow's skin, typically inside the ear or on the udder. This method requires specialized tattooing equipment and expertise to accurately apply the identification code. Tattoos provide a permanent and visible identification method but may require closer inspection to read the codes effectively.	
Neck chains	A chain with a unique number or code is placed around the cow's neck as an identification marker. The number or code can be visually read or scanned. Neck chains provide a visible and easily readable identification method.	

Practical activity-8	Ear Tagging
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A. Resources required

- Ear tags: The tags themselves are made of either plastic or metal. Plastic ear tags are more commonly used due to their durability, flexibility, and ease of customization. Metal ear tags, typically made of stainless steel, are also available but less common.

- **Ear tag applicator:** An ear tag applicator is required to attach the ear tags to the cow's ear. The applicator is a specialized tool designed to securely and effectively pierce the ear and attach the tag. It usually consists of a handle, a pin or needle for piercing the ear, and a mechanism to secure the tag in place.
- **Disinfectant:** Before applying the ear tag, it is essential to clean and disinfect the cow's ear to minimize the risk of infection. Disinfectant solutions, such as iodine or alcohol-based solutions are commonly used for this purpose.
- **Identification records:** This includes record system that links each ear tag's unique number or code to the corresponding cow's information, such as breed, age, health records, and production data.

B. Procedures

1. Use a disinfectant solution, such as iodine or alcohol-based solution, to clean the area of the cow's ear where the tag will be applied. This helps reduce the risk of infection and ensures a clean surface for tag attachment.
2. Choose an ear tag that is suitable for your specific identification needs, such as a plastic tag with a unique number or code.
3. Insert the ear tag into the applicator
4. Apply gentle pressure with the applicator to pierce the cow's ear. The applicator's pin or needle should pass through the ear smoothly and cleanly, creating a hole for the tag.
5. Once the ear is pierced, release the tag's pin or prongs from the applicator.
6. Double-check that the tag is properly attached and clearly visible.

Self-check question -8	Written test
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Write correct answer for the following questions

1. Write 4 method used for dairy cattle identification
2. Write 2 materials that used for ear tagging methods

3.4. New Born Calf Management

Newborn calves refer to calves that have recently been born, typically within a few hours or days. A calf is the offspring of a cow or female bovine. When a cow gives birth, the resulting calf is considered a newborn.

Newborn calves are in the early stages of their life and require special care and attention to ensure their health and development. Calving is the process of a cow giving birth to a calf. It is a natural and critical event in the life cycle of cattle. Proper management during calving is essential to ensure the health and well-being of both the cow and the new-born calf. By focusing on providing colostrums quickly, in sufficient quantity, and of good quality to dairy cow calves, farmers can ensure that the calves receive optimal immune support and develop a strong immune system to safeguard their health in the early stages of life. For dairy cow calves, the three Qs of colostrums feeding for successful immunity are as follows:

- **Quick:** It is important to provide colostrums to dairy cow calves as quickly as possible after birth. The first feeding should ideally occur within the first two hours of life. During this time, the calf's ability to absorb antibodies from the colostrums is highest. Delaying colostrum feeding can result in reduced absorption of antibodies and decreased immune protection.
- **Quantity:** Dairy cow calves should receive an adequate quantity of colostrum. It is recommended that they consume at least 10% of their body weight in colostrum within the first 6 hours of life. This ensures that they receive a sufficient amount of antibodies and other immune factors necessary for developing a strong immune system.
- **Quality:** The quality of colostrum is crucial for successful immunity in dairy cow calves. High-quality colostrum should contain a high concentration of antibodies. Colostrum from healthy cows, preferably from the calf's own dam, is typically of higher quality.

If the calf is not nursing or the mother is not producing enough milk, it may need to assist with bottle feeding or using an esophageal feeder with colostrum or milk replacer. Milk replacer is a commonly used substitute for cow's milk when feeding calves. It is a formulated powder that contains a balance of nutrients necessary for the healthy growth and development of the calf. General steps to prepare milk replacer include:

- **Gather the necessary ingredients:** You will need a commercial milk replacer specifically formulated for calves. These replacers are available in powder form and can be found at agricultural supply stores or veterinary clinics. Follow the instructions on the package for the appropriate amount of replacer powder.
- **Measure water:** Fill a clean container with warm water. The water temperature should be around 110°F (43°C). Measure the required amount of water according to the instructions on the milk replacer package. The water should be clean and free from any contaminants.

- Add milk replacer powder: Gradually add the measured amount of milk replacer powder into the warm water while stirring continuously. Follow the recommended mixing ratios provided on the package. It's important to add the powder to the water and not the other way around to prevent clumping.
- Mix thoroughly: Stir the mixture vigorously until all the powder is dissolved. Ensure there are no lumps remaining. The resulting solution should be smooth and consistent.
- Cool the milk replacer: Allow the milk replacer to cool down to a temperature of around 100°F (38°C) before feeding it to the calves. Use a thermometer to monitor the temperature, as it should be warm but not too hot.
- Feed the calves: Pour the prepared milk replacer into clean bottles equipped with appropriate nipples. Feed the calves using the bottles, similar to how you would feed them with natural milk.



Figure 20: Colostrum feeding through esophageal feeder tube and Colostrum bottle feeding



Figure 21: Milk bucket feeding

Calve weaning



Figure 22: Oral calf feeder drencher

Calf weaning refers to the process of transitioning young calves from a liquid diet (milk or milk replacer) to a solid feed-based diet. Weaning is an important milestone in calf development and should be done gradually to minimize stress and ensure successful transition. Steps involved in calf weaning:

- **Age and readiness:** Calves are typically weaned between 6 to 10 weeks of age, although the exact timing may vary depending on the specific circumstances and management practices. Before weaning, make sure the calves are physically capable of consuming solid feed and have developed a functional rumen.
- **Introduce solid feed:** Start by introducing solid feed while continuing to provide milk or milk replacer. Begin offering small amounts of high-quality calf starter feed (a high-quality calf pellet) in a separate feeder or trough for usually around 2-3 weeks of age. The starter feed should be palatable and easily digestible.
- **Gradual reduction of milk:** Over a period of several weeks, gradually reduce the amount of milk or milk replacer provided to the calves. Monitor their response and adjust the rate of reduction based on their individual progress. This allows the rumen to adapt and develop the ability to digest and utilize solid feed.
- **Increase solid feed intake:** As the calves become more accustomed to solid feed, gradually increase the quantity and frequency of feeding. Offer fresh starter feed multiple times a day, ensuring that it is easily accessible and of good quality. Provide adequate space for each calf to eat without competition.
- **Water availability:** Alongside solid feed, provide clean and fresh water to the calves at all times. Water is crucial for rumen development and aids in the digestion of solid feed. Ensure water sources are easily accessible and regularly cleaned.
- **Post-weaning care:** Once the calves are fully weaned from milk or milk replacer, gradually transition them to a balanced diet suitable for their age and nutritional requirements. Provide ample forage and continue monitoring their growth and health.

Practical activity-9	Perform calves management activities
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A. Resources required

- **Clean and dry calving area:** This space should be free from dirt, moisture, and sharp objects to minimize the risk of infection or injury to the cow and calf.
- **Individual pens:** Separate spaces are necessary for individual calf management.
- **Clean towels or disposable towels:** These are used to dry off the newborn calf after birth.

- **Gloves:** Wearing gloves during calving helps maintain hygiene and reduces the risk of introducing infections.
- **Colostrum replacer or fresh colostrum:** Colostrum is the first milk produced by the cow after calving, is rich in essential antibodies and nutrients.
- **Feeding bottles or esophageal feeders:** These are required if the mother is unable to nurse or produce enough milk. Feeding bottles or esophageal feeders allow for controlled feeding of the calf.
- **Milk replacer:** This is necessary for feeding orphaned calves or supplementing insufficient maternal milk production.
- **Calf milk feeder or bucket:** A dedicated container is needed for feeding milk to young calves. It should be clean and easily accessible to the calf.
- **Clean water source:** Once the calf is a few days old, it should be provided with fresh and clean water for hydration and to support its growth.
- **Clean and dry bedding:** Comfortable and clean bedding is essential for the calf's well-being.
- **Calf jackets or blankets (optional):** In colder climates or seasons, calf jackets or blankets can provide additional warmth and protection for the newborn calf.

B. Procedures

1. Ensure the calving area is clean, dry, and well-bedded. Remove any sharp objects or hazards that could harm the calf or mother.
2. Monitor the cow closely during delivery. If assistance is needed, consult a veterinarian or experienced personnel to ensure a safe and successful birth.
3. After the calf is born, use clean towels to gently dry off the calf. Pay particular attention to drying the head and removing any mucus or fluids from the nostrils and mouth to help clear the airways.
4. Provide colostrum 10% of the calf's body weight within the first 6 hours.
5. If the calf is unable to nurse or if the cow's colostrum is insufficient, use a colostrum replacer or provide fresh colostrum from a healthy cow.
6. If the calf is nursing from the mother, observe to ensure it is latching properly and receiving sufficient milk. If the calf is not nursing or the mother is not producing enough milk, you may need to assist with bottle feeding or using an esophageal feeder with colostrum or milk replacer.
7. Provide a clean and comfortable environment: This helps prevent infections and provides a comfortable resting area. Consider using individual pens to separate each calf for proper management.

8. Once the calf is a few days old, provide access to clean water in a shallow container or nipple waterer. Introduce solid feed gradually, starting with calf starter or a high-quality calf pellet and provide immature green forage for usually around 2-3 weeks of age.
9. Regularly observe the calf for any signs of illness, such as lethargy, diarrhea, or respiratory distress. Seek veterinary assistance if you notice any abnormalities or concerns.
10. Let calves socialize or exercise: Socialization is an important aspect of calf management that involves allowing calves to interact and socialize with other calves. Group pens and pasture or outdoor can be used for socialization.

Self-check question -9	Written test
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Write the correct answer for the following questions

1. Write 4 resources needed for managing newborn calves?
2. Why is providing colostrum important for newborn calves?

3.5. Heifer Management

A heifer is a young female bovine that has not yet given birth to a calf. The age at which a heifer reaches sexual maturity and can be bred typically ranges from around 12 to 15 months, although this can vary among breeds and individual animals.

- Holstein-Friesian (HF) heifers typically reach sexual maturity and can be bred between 13 and 15 months of age. However, it's important to consider the heifer's size and weight as well. Ideally, HF heifers should weigh around 60% of their mature body weight before being bred. This usually corresponds to a weight of around 320-350 kg.
- Jersey heifers tend to reach sexual maturity earlier compared to HF heifers. They can generally be bred between 11 and 13 months of age. Similar to HF heifers, it is recommended that Jersey heifers reach a target weight of around 60% of their mature body weight before breeding, which is typically around 230-250 kg.
- Local breed heifers: The age at which local breed heifers reach sexual maturity can vary depending on the specific breed and environmental conditions. Generally, they can be bred between 12 and 16 months of age. It's important to monitor their growth, weight, and overall development to determine the appropriate time for breeding.

A cow shall give the maximum productive and reproductive performance only when provided with proper care and management at her heifer stage. The following management practices are recommended for a heifer.

- Feed the heifer sufficiently for her normal growth. There is relatively more protein requirement during the early stage.
- Train heifers to be comfortable with handling procedures such as haltering, leading, and loading onto trailers.
- Regularly handle heifers to reduce stress during routine tasks such as milking and veterinary procedures.
- Move the heifer to a separate shed about 6-8 weeks before the expected date of calving.
- Maintain proper hygiene and take necessary preventive steps against common diseases to ensure her good health.
- Take extra care during calving of a heifer because it is her first calving and she may have difficulty in it.

Self-check question -10	Written test
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Write the correct answer for the following questions

1. Write at least 5 main considerations for effective heifer management
2. At what age heifer can reaches sexual maturity

3.6. Dairy Cow Management

The management of cows refers to the set of practices and strategies implemented to care for and oversee the well-being, productivity, and overall management of a herd of cows. Managing cows during different stages of lactation requires specific attention to their nutritional needs, health, and productivity. Key management activities for each stage include:

Early lactation management (first 60 to 90 days after calving)

- **Nutrition:** Offer a balanced ration with adequate amounts of high-quality forage, concentrate feed, and supplementation if necessary to support the cow's high energy and protein requirements during peak milk production.

- **Milk production monitoring:** Regularly monitor milk production to ensure cows are reaching their full production potential. Identify and address any issues affecting milk production, such as mastitis or metabolic disorders.
- **Health management:** Implement a proactive health program, including vaccinations, deworming, and regular veterinary check-ups. Monitor for common early lactation health issues like metritis or ketosis, and promptly treat any signs of illness or disease.
- **Cow comfort:** Ensure cows have comfortable housing, proper ventilation, and access to clean water. Minimize stressors and provide adequate resting areas to support cow well-being.

Mid-lactation management (90 to 180 days after calving)

- **Nutrition:** Continue providing a balanced diet with appropriate energy and protein levels to support milk production. Adjust the ration based on milk yield, body condition, and forage quality. Monitor dry matter intake and ensure adequate nutrition.
- **Reproduction management:** Implement a reproductive management program to optimize conception rates and manage the cow's breeding schedule. Monitor heat signs, consider artificial insemination (AI), and work with a veterinarian to determine the appropriate breeding protocols.
- **Health management:** Continue with a comprehensive health program and monitor for any signs of illness or metabolic disorders. Focus on preventing mastitis, lameness, and other common mid-lactation health issues.
- **Cow comfort:** Maintain comfortable housing conditions and ensure cows have access to clean water, comfortable resting areas, and proper ventilation.
- **Late lactation management (180+ days after calving)**
- **Nutrition:** Adjust the diet to meet the cow's reduced energy and protein requirements as milk production decreases. Focus on maintaining body condition and providing adequate nutrition for the developing fetus in pregnant cows.
- **Dry Cow Preparation:** Begin transitioning cows into the dry period diet, gradually reducing milking frequency and adjusting the ration. Implement appropriate dry cow management practices, such as teat sealing and udder health monitoring.
- **Health Management:** Continue with regular health monitoring, including vaccinations, deworming, and veterinary check-ups. Monitor for any signs of disease or reproductive issues.
- **Reproduction Management (for pregnant cows):** Confirm pregnancies and manage the cow's breeding schedule. Monitor the cow's condition and prepare for calving.

Dry cow management

- The dry period provides an opportunity for the mammary gland to rest and regenerate. As cows transition from lactation to the dry period, milk production decreases and allowing the mammary gland to recover from the demands of milk synthesis. Proper nutrition during the dry period is crucial for supporting the recovery of mammary milk-secreting cells. The transition diet should provide adequate energy, protein, and essential nutrients to support the regeneration and development of the mammary gland. A balanced diet helps ensure that the cow enters the next lactation cycle with a healthy and functional udder. The number of days to dry off, also known as the dry-off period, can vary depending on several factors, including the cows stage of lactation, milk production, and the management practices of the farm. The typical dry-off period ranges from 45 to 60 days before the expected calving date. Activities in dry cow management include:
 - Transition cows gradually from their lactation diet to a dry cow diet.
 - Provide a balanced diet with lower energy and protein levels.
 - Apply internal teat sealant or dry cow antibiotic infusion to prevent new intra mammary infections.
 - Maintain clean and dry bedding to reduce the risk of environmental mastitis.
 - Regularly examine udders for any signs of abnormalities and treat existing infections promptly.
 - Administer necessary vaccinations and deworming treatments.
 - Maintain accurate records of cow identification, health treatments, and breeding dates.

Prepare the maternity house

When the dry-off cow reaches calving time, it's important to prepare the maternity house to provide a comfortable and safe environment for the cow during the calving process.

- Thoroughly clean and disinfect the maternity house prior to the arrival of the cow. Remove any old bedding, manure, and debris. Clean all surfaces, including walls, floors, and calving pens, using appropriate disinfectants to reduce the risk of disease transmission.
- Provide clean and comfortable bedding in the calving pens. Straw, sand, or specialized calving mats are commonly used bedding materials. Ensure that there is an ample amount of bedding to provide cushioning and support for the cow during calving.

- Ensure that each calving pen provides enough space for the cow to move around comfortably. The pen should be large enough to accommodate the cow and her calf while allowing easy access for observation and intervention if needed.
- Gather and organize the necessary calving supplies and equipment. This may include lubricants, disinfectants, and clean towels. Have them readily available in the maternity house for quick access during the calving process.
- Ensure that the maternity house has proper ventilation to maintain fresh air and minimize the buildup of odors and ammonia. Good air quality promotes cow comfort and reduces the risk of respiratory issues.



Figure 23: Cow comfort in the maternity house

Self-check question -11	Written test
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Match the name under column A with its description under column B

A	Answers	B
1. Early lactation management		A. Preparing a comfortable and safe calving environment through cleaning, bedding, space, and gathering supplies
2. Mid-lactation management		B. Managing cows during 90 to 180 days after calving, emphasizing nutrition, reproduction, health, and comfort.
3. Late lactation management		C. Managing cows 180+ days after calving, involving nutrition adjustment, dry cow prep, health, and reproduction.
4. Dry cow management		D. Managing cows during the dry period between lactations, including diet transition, udder health, and comfort.
5. Maternity house preparation		E. Managing cows during the first 60-90 days after calving, focusing on nutrition, milk production, health, and comfort.
		F. Pregnant cow

3.7. Maintaining Proper Hygiene and Health

Maintaining proper hygiene and health in dairy cow management is crucial for the well-being of the cows, the quality of milk produced, and the sustainability of the farm.

3.7.1. Hygiene

Hygiene refers to conditions and practices that help to maintain health and prevent spread of diseases. Some important aspects of hygiene practices to consider when it comes to dairy cow management:

A. Cleaning dairy cattle barn

Maintaining a clean and hygienic environment in a dairy cattle barn is crucial for the health and productivity of the animals. It involves eliminating accumulated manure and bedding thoroughly cleaning all surfaces. This process helps remove dirt, bacteria, and pathogens that could harm the cattle. After cleaning, it is better to apply disinfectants. Disinfection involves applying appropriate disinfectants to kill remaining microorganisms and prevent disease transmission.



Figure 22: Removing manure from barn with shovel and washing barn with water



Figure 26: Disinfecting barn

B. Milker hygiene

Maintaining proper hygiene during milking is crucial to ensure the safety and quality of the milk. Milkers should practice good personal hygiene by washing their hands thoroughly with soap and clean water before and after milking. This helps prevent the transfer of bacteria and contaminants to the milk. Milkers should wear clean and appropriate clothing during milking like boots and overall.



Figure 27: Hand washing with soap

Figure 28: Wearing protective equipment during milking

C. Animal's hygiene

Maintaining hygiene in animals involves various practices to ensure their cleanliness and overall well-being. Regularly groom the animal's coat by brushing or combing to remove dirt, loose hair, and debris. This helps keep their coat clean and reduces the risk of skin issues. Check their skin for any signs of irritation, wounds, or infections, and consult a veterinarian if needed. Udder hygiene is crucial for dairy cattle to maintain milk quality and minimize the risk of mastitis, a common udder infection. Here are some guidelines for udder hygiene in dairy cattle:

- Before milking, clean the udder and teats to remove dirt, manure, and bacteria. Use warm water, mild detergent, and individual disposable towels or clean cloth for each cow. Start cleaning from the front of the udder and move backward, taking care not to contaminate previously cleaned areas. Apply a suitable udder wash or cleaning solution, and use a soft brush or your hands to gently scrub the udder and teats in a circular motion.
- After washing, dry the udder and teats thoroughly using individual towels or disposable wipes. Ensure the towels are clean and dry for each cow to avoid cross-contamination.
- After milking apply a suitable teat dip or spray recommended by a veterinarian. Teat dips or sprays help to sanitize the teats and provide a protective barrier against bacteria.



Figure 29: Udder and teat cleaning with towel Figure 30: Teat dipping

D. Milking utensils hygiene

Proper hygiene in milking utensils is essential to ensure the safety and quality of milk. Contamination during the milking process can lead to compromised milk quality, increased bacterial growth, and potential health hazards for both animals and consumers. Cleaning and disinfection are critical steps in maintaining proper hygiene for milking utensils. These practices help eliminate bacteria, microorganisms, and residue that may contaminate milk and compromise its quality.



Figure 31: Cleaning milking machine Figure 32: Cleaning milking equipment with detergent

E. Maintaining milk hygiene during transportation

Strict hygiene prevents milk from spoiling or contaminating which can cause serious food borne illnesses. Milk is very perishable, so protecting it keeps all those who consume it safe. Points considered maintaining milk hygiene during transportation:

- Check local temperature guidelines for safe milk transportation. In hot weather, use frozen cooling packs/blocks to keep milk at 4°C or below.
- Consider small portable coolers with temperature control if transporting milk long-distances or across different climate zones.
- Use crates/containers designated only for milk and dairy to avoid cross-contamination from other foods during transport.
- Clearly label milk packages with expiration dates so they are not confused with older stock upon arrival at destination.
- When transporting via public vehicles, avoid placing milk in overhead racks or under seats where it may shift/tip over. Inform the driver that you are carrying perishable items.
- In flights, use thermoses or vacuum-insulated bottles/jugs for milk to maintain temperature in cargo holds.
- Thoroughly clean and sanitize coolers, crates and other transport equipment after each milk delivery to kill any lingering bacteria.

Practical activity-10	Cleaning and disinfecting dairy cattle barn
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A. Resources required

- Cleaning equipment (brooms, shovels, scrub brushes, etc.)
- Disinfectants (Hydrogen peroxide, Iodine solution, Sodium hypochlorite and *etc.*) suitable for dairy farm use
- Pressure washers or hoses for effective cleaning
- Sprayers or foggers for applying disinfectants.

B. Procedures

1. Wear appropriate personal protective equipment (PPE) before cleaning and disinfecting process, such as overall, gloves, goggles, boots, and masks, to protect harmful chemicals and pathogens.

2. Before starting the cleaning process, remove all the cattle from the barn and relocate them to a safe and clean area.
3. Begin by removing all the bedding material, such as straw or sawdust, from the barn. Dispose of the soiled bedding properly. Use a pitchfork or shovel to remove any accumulated manure from the floor and alleys.
4. Sweep the entire barn, including walls, floors, and any equipment or fixtures, to remove loose debris. Use a stiff brush or broom to scrub the surfaces thoroughly. Pay special attention to areas that are difficult to reach or frequently come into contact with animals, such as feeders, water troughs, and gates.
5. If available, use a pressure washer or power washer to thoroughly clean the barn's surfaces. Start from the top and work your way down, ensuring that all areas are covered.
6. After power washing, prepare the disinfectant solution according to the manufacturer's instructions. Dilute the disinfectant with water as recommended to achieve the appropriate concentration for effective disinfection. You can use Hydrogen peroxide, Iodine solution, Sodium hypochlorite disinfectant and etc. For example: Common dilution ratios for Hydrogen Peroxide range from 1:10 to 1:50 (1-part hydrogen peroxide to 10 or 50 parts water).
7. After diluted the disinfectant use a sprayer or handheld sprayer to evenly distribute the detergent or disinfectant. Ensure all surfaces are thoroughly coated, including walls, floors, and equipment.
8. After applying the disinfectant, allow it to remain on the surfaces for the recommended contact time. This allows the product to effectively kill microorganisms and pathogens. Contact time can vary depending on the concentration and specific product. The recommended contact time of Hydrogen Peroxide is 5-10 minutes for effective disinfection.
9. Once the contact time has finished, thoroughly rinse all surfaces with clean water. Remove any residual detergent or disinfectant from the barn. Pay attention to corners, drains, and other areas where detergent or disinfectant may accumulate.
10. Properly ventilate the barn to ensure it dries completely. Adequate airflow helps prevent the growth of mold and bacteria. If possible, use fans. Open doors and windows; open them to allow for natural air circulation. This will help remove moisture and facilitate drying.
11. In average circumstances, after disinfection with hydrogen peroxide, it is generally recommended to wait for the surface to dry completely before introducing animals. This typically takes around 30 minutes to 1 hour, depending on factors such as temperature, humidity, and ventilation.

Practical activity-11	Cleaning and sanitization milking utensils
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A. Resources required

- Cleaning supplies, including brushes, sponges, and hoses.
- Detergents (example: Alkaclean solution) and sanitizers (Example: sodium hypochlorite, Iodine-based sanitizers) suitable for dairy equipment and surfaces
- Lukewarm water: Used for pre-rinsing, rinsing, and potentially as part of the sanitizing process.
- Hot water: If using heat as a sanitizing method, you will need access to hot water at a temperature of approximately 180°F (82°C).

B. Procedures

1. Rinse the milking utensils, like milk buckets with warm water to remove any residual milk.
2. After removing any residual milk wash by using a suitable detergent or cleaning agent specifically designed for dairy equipment. For example: let use an alkaline cleaner like Alkaclean for cleaning milking equipment:
3. Prepare the Alkaclean solution according to the recommended dilution ratio according to manufacture instruction. Add the appropriate amount of Alkaclean to the required volume of water and mix thoroughly to ensure proper dispersion.
4. Apply the diluted Alkaclean solution to all surfaces of the milking equipment that require cleaning. Use a brush or sponge to scrub all surfaces, including the inside and outside of buckets, teat cups, hoses, and any other components that come into contact with milk.
5. Agitate or scrub the equipment with the Alkaclean solution using the brush or sponge. This helps to loosen and remove dirt, milk residues, and organic matter.
6. After the appropriate contact time or soaking period, thoroughly rinse all surfaces of the milking equipment with clean, lukewarm water. Ensure that all traces of Alkaclean are removed from the equipment.
7. Allow the cleaned equipment to drain and air dry in a clean and well-ventilated area. Avoid using cloths or towels to dry the equipment, as they can introduce contaminants.

3.7.2. Health

Maintaining the health of dairy cattle is essential for their well-being and productivity. By implementing proper nutrition, hygiene practices, disease prevention measures, and regular veterinary care, you can ensure the overall health of your herd. Disease prevention is crucial for maintaining the health and productivity of dairy cattle. Key strategies to prevent diseases in dairy cattle:

Vaccination: Vaccination refers to the administration of a vaccine to stimulate the immune system of an individual, whether it's a human or an animal, to develop protection against specific diseases. Vaccines contain weakened or killed forms of pathogens (such as viruses or bacteria) or their proteins, which are designed to trigger an immune response without causing the actual disease. Develop a vaccination program in consultation with a veterinarian. Vaccines can protect against common infectious diseases such as: Bovine viral diarrhea (BVD), Infectious bovine rhinotracheitis (IBR), Bovine respiratory syncytial virus (BRSV), Clostridia diseases (e.g., blackleg, tetanus) and etc.

Biosecurity Measures: Biosecurity measures are a set of practices and protocols implemented to prevent the introduction and spread of diseases within livestock populations. These measures aim to protect the health and well-being of animals by minimizing the risk of disease transmission. Measures commonly used in livestock management, including dairy cattle:

- **Restricted visitor access:** Limit access to the farm and implement protocols for visitors, such as requiring disinfection of footwear and clothing.
- **Quarantine:** Isolate newly purchased or returning animals for a period of time to monitor and prevent the introduction of diseases.
- **Sanitation protocols:** Establish strict hygiene protocols, such as hand washing, equipment disinfection, and proper waste management.
- **Minimize contact with other herds:** Reduce contact between your herd and other cattle farms or livestock to minimize the risk of disease transmission.
- **Parasite Control:** Parasite control is an important aspect of dairy cow management to maintain their health and productivity. Internal and external parasites can negatively impact the well-being and performance of dairy cattle. Key considerations for parasite control in dairy cows:
- **Deworming:** Deworming, also known as anthelmintic treatment refers to the administration of medications or dewormers to eliminate or control internal parasites (worms) in animals. These parasites

can include various types of worms, such as roundworms, tapeworms, flukes, and lungworms that can infest the gastrointestinal tract, lungs, liver, or other organs of animals.

- Fly control: Use appropriate methods to control flies, such as fly traps, insecticide sprays, and maintaining clean housing and manure management practices.
- Tick and lice control: Implement measures to control ticks and lice, such as topical treatments and proper grooming.

Self-check question -12	Written test
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Write correct the answers for the following questions

1. What are key practices for maintaining hygiene in dairy cow management?
2. What are some measures for disease prevention and management in dairy cows?

3.8. Record Keeping

Keeping accurate and up-to-date records is essential for effective dairy cow management. Proper record keeping allows for better decision-making, monitoring performance, and complying with regulatory requirements. There are several types of records that are important in dairy cattle management:

Identification Records: Identification records are important documents that track the unique identification of individual animals in livestock management. These records help in maintaining accurate and organized information about each animal, facilitating effective management, monitoring, and traceability. Identification records typically include details about the identification method used, such as ear tagging, tattooing, as well as relevant information associated with the identification event.

Health Records: Documentation of the health status of individual cows, including vaccination history, deworming treatments, and any medications administered.

Table 8: Dairy cow health recording sheet

Animal ID	Date	Event	Diagnosis	Treatment	Dosage	Veterinarian

Reproduction records: Records related to the breeding and reproductive history of cows, including breeding dates, pregnancy status, and calving records.

Table 9: Dairy cow Reproduction recording sheet

Animal ID	Date	Reproduction Event	Breeding Method	Sire ID/Tag	Dam ID/Tag	Pregnancy Status	Birth Date	Remarks

Milk production records: A milk production record is a documented record that captures information about the milk production of dairy cows. It serves as a valuable tool for dairy farmers to monitor and analyze the performance of individual cows, assess overall herd productivity, and make informed management decisions.

Table 10: Milk production recording sheet

Date	Cow ID/Name	Morning Milking	Afternoon Milking	Evening Milking	Total Daily Milk Yield

Feed and nutrition records: Records that track feed inventory, ration formulations, and feed consumption to ensure proper nutrition for the cows.

Table 11: Feeding record sheet

Animal ID/Tag	Date	Feed Type	Feed Quantity (kg)	Feed Frequency	Concentrate (%)	Remarks

Financial records: Records related to the financial aspects of the dairy farm, including expenses, income from milk sales, and profit/loss statements.

Table 12: Financial record sheet

Date	Description	Income (ETB)	Expense (ETB)

Date	Description	Income (ETB)	Expense (ETB)

Breeding and genetic records: Records that track genetic evaluations, breeding plans, and genetic test results to manage the breeding and genetic improvement of the herd.

Table 13: Breeding and genetic records sheet

Date	Animal ID	Sire ID	Dam ID	Breeding Type	Result

Practical activity-12	Keep records for dairy cattle farm
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A. Resources required

- Record books or digital software: It used to document various aspects of your dairy operation. These can be physical notebooks or digital equivalents, such as spreadsheets or specialized software.
- Writing Instruments: Have pens, pencils, or markers readily available to write and update records. It's important to use permanent markers or pens that won't fade or rub off over time.

B. General procedure for record-keeping

1. Identify the types of records that you want to track and record.
2. Create a standardized format or template for each category of record. You can use record books or digital tools and software
3. Assign unique identification numbers or codes to each cow in your herd. Use identification tags or ear tags to mark the cows and link them to their respective records.
4. Record all information on the prepared template.

5. Store the document in the safe place

Self-check question -13	Written test
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Match the description of dairy farm records under column A with its types under column B

No	A	Answers	B
1	Records that uniquely identify each cow		A. Feed and Nutrition Records
2	Documentation including vaccination history and deworming treatments		B. Health Records
3	Records related to breeding dates, pregnancy status, and calving records		C. Reproduction Records
4	Records that track the amount milk produced		D. Production Records
5	Records related to ration formulations, and feed consumption		E. Identification Records
6	Records related to expenses, income from milk sales, and profit/loss statements		F. Financial Records
			House records

Unit Summary

Dairy cattle management involves providing clean and comfortable housing, developing a balanced diet, implementing a herd health program, maintaining milk quality, keeping accurate records, and managing breeding and herd performance. Cows should have adequate space and ventilation in their housing, while their nutrition needs to be carefully balanced with high-quality forages and concentrates. Regular veterinary

care, including vaccinations and reproductive management, is crucial. Milking must be done hygienically, with clean equipment and proper storage practices for milk. Record keeping help for decision-making.

Unit Review Questions

1. What is the ideal body condition score range for dairy cows?
 - A. 1 to 2
 - B. 2.5 to 3
 - C. 3 to 3.5
 - D. 4 to 5
2. How would you describe a cow with a body condition score of 4?
 - A. Emaciated
 - B. Thin
 - C. Moderate
 - D. Fat
3. What is the primary purpose of providing colostrum to newborn calves?
 - A. To promote socialization and exercise
 - B. To ensure proper hydration
 - C. To provide essential nutrients and antibodies
 - D. To facilitate weaning and transitioning
4. What is one of the key considerations for ensuring the health and well-being of heifers?
 - A. Providing colostrum
 - B. Implementing reproductive management
 - C. Monitoring milk production
 - D. Encouraging socialization and exercise
5. What is the gestation period for cows?
 - A. 3 months
 - B. 6 months
 - C. 9 months
 - D. 12 months
6. What is a key consideration for managing dry cows?
 - A. Monitoring of milk production
 - B. Providing a clean and comfortable resting area
 - C. Implementing a milking routine
 - D. Adjusting the diet during the lactation period
7. What is an important aspect of maintaining hygiene in dairy cow management?
 - A. Regular vaccination programs
 - B. Clean and sanitized milking equipment
 - C. Proper hoof trimming
 - D. Implementing nutrient management practices

8. What is a key consideration for ensuring the health of dairy cows?

- A. Proper manure management
- B. Regular veterinary care
- C. Implementing conservation practices
- D. Balancing nutrient inputs and outputs

9. What type of record tracks the milk production of each cow?

- A. Identification records
- B. Health records
- C. Reproduction records
- D. Milk production records

10. Which type of record includes information about breeding dates and calving records?

- A. Health records
- B. Reproduction records
- C. Feed and nutrition records
- D. Financial records

Answer key for self-check questions

Self-check question -6

- 1. E
- 2. B
- 3. C
- 4. D

Self-check question -7

- 1. Hoof cutter, hoof trimmer
- 2. 9-12 mm

Self-check question -8

- 1. Ear tagging, ear notching, neck chain, tattoos
- 2. Ear tag, ear tag applicator

Self-check question -9

- 1. Feeding bottle, milk replacer, bedding materials, colostrum
- 2. It rich in essential antibodies and nutrients

Self-check question -10

1. Proper feeding, train heifers, keep hygiene, extra care during calving and move the heifer to a separate shed about 6-8 weeks before the expected date of calving.

2. 12 to 15 month of age

Self-check question -11

1. E 2. B 3. C 4. D 5. A

Self-check question -12

1. Cleaning milking materials keep personal hygiene, maintain milker hygiene and animals
2. Using vaccination, use biosecurity and control parasite

Self-check question -13

1. E. 2. B 3. C 4. D 5. A 6. F

Project Work

LAP TEST 3

Manage dairy cattle

Instructions: Visit one model dairy farm and given necessary templates, tools and materials you are required to perform the following tasks within **6** hours. The project is expected from each trainee to do it.

Task-1. Select 5 dairy cows and perform body condition scoring

Task-2. Perform hoof trimming

Task-3. Perform ear tag identification

Task-4. Perform calves' management activities

Task-5. Perform record keeping

UNIT 4

Dairy Cow Milking Operation

Learning outcomes

At the end of this unit, the students will be able to

- Identifying and responding Occupational health and safety hazards
- Perform milking methods

Key terms

- Milking
- Hazards

Unit Introduction

What are milking methods?

Milking operations are a vital component of dairy farming, encompassing the extraction of milk from cows using various methods and techniques. This process is crucial for maintaining milk production and ensuring the well-being of the cows. Milking methods can vary depending on the farm's resources, technology available, and management practices. Traditional milking involves manually extracting milk from cows using hands. This method requires skilled milkers who apply proper hand techniques to stimulate milk let-down and ensure effective milk flow. Traditional milking can be time-consuming and labor-intensive, particularly on larger dairy farms. Machine milking, also known as mechanical milking, is a widely adopted method in modern dairy operations. It involves using milking machines that attach to the cow's teats, creating a vacuum to extract milk. Machine milking offers several advantages, including increased efficiency, standardized milking practices, and the ability to handle larger herds. It also reduces labor demands and provides consistent milk extraction.

4.1. Occupational Health and Safety Hazards

Occupational health and safety hazards can be present during dairy cattle milking operations. It's important for dairy farmers and workers to be aware of these hazards and take appropriate measures to mitigate risks. Common hazards associated with dairy cattle milking are:

A. Physical Injuries

Physical injuries on a dairy farm can occur due to various factors. Physical injuries commonly associated with working on a dairy farm include:

- Wet or uneven surfaces, spills, or obstacles can lead to slips, trips, and falls, causing injuries.
- Working with large animals poses risks such as kicks, bites, or being crushed against walls or fences.
- Handling heavy machinery like tractors, loaders, or milking equipment can result in accidents if not operated safely.

B. Zoonotic Diseases

Zoonotic diseases are infections that can be transmitted between animals and humans. Dairy workers may be at risk of contracting diseases. Those include:

- Contact with infected animals or their feces can lead to salmonellosis, causing gastrointestinal symptoms.
- Dairy cows infected with Brucella bacteria can transmit the disease to humans, causing flu-like symptoms.
- A fungal infection commonly found in cows, which can be transmitted to humans through direct contact.
- A bacterial infection primarily transmitted from livestock, causing flu-like symptoms and potentially severe complications.

C. Chemical Exposure

Workers may be exposed to chemicals and disinfectants used in cleaning milking equipment or treating cow udders. Prolonged exposure or improper handling of these substances can lead to skin irritations, respiratory issues, or other health problems. Those hazards include:

- The use of chemicals for crop management can lead to exposure risks if not handled properly.
- Frequent use of cleaning agents and disinfectants may involve exposure to harmful substances.
- Handling and administering medications to animals can pose risks if not done following safety guidelines.

D. Electrical Hazards

It's important to note that proper installation, maintenance, and adherence to electrical safety practices are crucial for ensuring overall safety on a dairy farm. When dealing with complex electrical systems or significant hazards, it is recommended to consult with a qualified electrician or electrical engineer for the most appropriate and effective solutions. Electrical hazards pose a significant risk on a dairy farm and can lead to severe injuries or even fatalities if not properly addressed. Those hazards include:

- Malfunctioning electrical systems or damaged equipment can present electrical hazards.
- Inadequate grounding of electrical systems can increase the risk of electric shock.
- Working with electrical equipment in wet or damp areas can heighten the risk of electric shock.
- Overloading electrical circuits with excessive power demands can lead to electrical fires or equipment damage.

Practical activity-13	Prevent hazards
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I. Physical injuries

A. Resource required

- Personal protective equipment (PPE): Gloves (chemical-resistant, cut-resistant, and/or disposable) and steel-toed boots or protective footwear
- Signage and labels: Warning signs for hazardous areas and safety posters displaying important safety guidelines and procedures
- First aid supplies: First aid kits equipped with bandages, gauze pads, adhesive tape, antiseptic solutions, scissors, tweezers, etc. Eye wash stations or emergency showers (if needed for specific hazards)
- Anti-slip shoes
- Lighting: Adequate lighting fixtures for work areas, walkways, and animal handling facilities
- Safety equipment for animal handling: Sturdy fences, gates, and chutes for secure animal containment. Headlocks or squeeze chutes for restraining larger animals and non-slip flooring or mats in milking parlors or handling areas

B. Procedure

1. Wear appropriate PPE, including gloves and steel-toed boots or protective footwear.
2. Install warning signs in hazardous areas, such as near machinery, or areas with slippery surfaces.

3. Stock first aid kits with essential supplies, including bandages, gauze pads, adhesive tape, antiseptic solutions, scissors, and tweezers.
4. Use anti-slip shoes to reduce the risk of slips, trips, and falls.
5. Install adequate lighting fixtures in work areas, walkways, and animal handling facilities to ensure good visibility.
6. Install headlocks or squeeze chutes for restraining larger animals during handling or veterinary procedures.

II. Zoonotic diseases

A. Resource required

- Personal protective equipment (PPE): Gloves, coveralls and rubber boots
- Cleaning agents: Detergents, soaps, and disinfectants suitable for dairy farm use, including those effective against bacteria, fungi, and viruses.
- Brushes and scrubbers: Stiff brushes and scrubbers for cleaning equipment, surfaces, and animal housing.
- Mats or footbaths filled with disinfectant solutions placed at entry points to prevent the spread of pathogens.
- Teat dip or spray: Antimicrobial solutions for post-milking teat disinfection to prevent mastitis and other infections.
- Separation facilities: Isolation areas or separate pens for sick or potentially infected animals.
- Testing kits: Diagnostic kits for detecting specific zoonotic diseases, such as brucellosis or tuberculosis.
- Vaccines: Vaccines for preventing common livestock diseases, as recommended by veterinarians.

B. Procedure

1. Use proper protective equipment when handling animals or contaminated materials.
2. Practice good personal hygiene, including hand washing with soap and water.
3. Isolate sick animals to prevent the spread of diseases.
4. Clean and disinfect animal housing, equipment, and surfaces.
5. Clean and sanitize milking equipment before and after each use.
6. Dispose of animal waste and contaminated materials safely.
7. Regularly monitor animals for signs of illness.
8. Quarantine animals suspected of carrying diseases.

III. Chemical exposure

A. Resource required

- Personal protective equipment (PPE): Gloves: Chemical-resistant gloves to protect hands. Goggles: Safety goggles or glasses to shield eyes from chemical splashes. Masks or Respirators: Use to prevent inhalation of harmful fumes or particles.
- Appropriate cleaning agents for equipment, surfaces, and animal housing.
- Disinfectants: Chemicals used to kill or inhibit the growth of harmful microorganisms.
- Chemical storage cabinets: Secure cabinets designed for storing chemicals safely.
- Fans or exhaust systems: Devices to improve air circulation and remove chemical fumes or vapors from enclosed spaces.
- Hazard labels: Labels indicating the type of chemical and its associated hazards.
- Cleaning tools and equipment: Brushes: Used for scrubbing equipment or surfaces during cleaning. Buckets and Mops: Containers and mops for cleaning floors and other large areas. Spray Bottles: Used to apply cleaning solutions or disinfectants.
- Hazardous waste containers: Special containers or bins for collecting and storing hazardous chemicals or waste.
- First aid supplies: First aid kit: A well-stocked kit containing items like bandages, antiseptics, and eyewash for providing immediate care in case of chemical exposure or injuries.

B. Procedure

1. Wear protective equipment: When working with chemicals, wear special equipment like gloves, goggles, and masks.
2. Stay away from chemicals: Never play with or touch chemicals without permission.
3. When chemicals are being used, stay in a safe area away from those places.
4. After working with chemicals or being near them, wash your hands with soap and water.
5. Pay attention to signs or labels that warn about chemicals.

Self -check question -14	Written test
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Matching the description under column **A** with types of hazards under column **B**

No	<u>A</u>	Answer	<u>B</u>
1	Cows kick		A. Health and safety
2	Disease that transmitted between animals and humans		B. Zoonotic Diseases
3	Workers may be exposed to chemicals and disinfectants		C. Chemical hazards
4	Milking parlors and related equipment involve electrical systems		D. Electrical Hazards
			E. Physical Injuries



4.2. Milking Methods

Milking methods refer to the various techniques and systems employed to extract milk from dairy animals, predominantly cows, in a controlled and efficient manner. These methods encompass a range of manual and mechanical approaches used in dairy farming to optimize milk production and ensure the well-being of the animals.

4.2.1. Hand milking




Hand milking is a method of manually extracting milk from a lactating animal. It is a traditional and labor-intensive technique that has been practiced for centuries. There are different methods of hand milking that can be used to extract milk from a dairy cow. Common methods of hand milking are listed in the following table.




Table 14: Common methods of hand milking

Method	Explanation	Image
Stripping	Involves using the thumb and forefinger to squeeze the teat from the base to the tip in a stripping motion, forcing the milk out into a container. Mainly used for small teat.	
Full hand milking	The entire teat is enclosed within the hand, with the thumb on one side and the other fingers on the opposite side. Gentle pressure is applied from the top of the teat to the base to force the milk out. Mainly used for small teat. Mainly used for large teat. Once the milk flow slows down, the milker switches to the stripping technique, squeezing and sliding the thumb and forefinger from the base to the tip of the teat to ensure thorough emptying of the udder. The best milking method is full hand milking that followed by strip milking.	

Practical activity-14	Perform hand milking
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A. Resource required

Materials and equipment	Purpose	Picture
Milking bucket	Collecting the milk during milking	
Stool or milking stand	The milker sit-down on it during milking	
Clean clothes or towels	Cleaning and drying the udder and teats	

Materials and equipment	Purpose	Picture
Milk strainer and filters	Straining the milk to remove impurities	
Milk collection container	Storing the collected milk	
Teat dip or spray	Disinfecting the teats after milking	

Materials and equipment	Purpose	Picture
Strip cup	Use to detect mastitis	
Record book	Used to record data	
Rope	To restrain cows during milking	

B. Procedure

1. Wear persona protective equipment.
2. Clean milking environment.
3. Lead the cow into the milking parlor or designated milking area.
4. Wash your hands thoroughly with soap and warm water.

5. Secure the cow in a milking stall or restraining device to prevent sudden movements or accidents. You can use rope to restrain animal
6. Clean the cow's udder and teats with a clean moist cloth or towel to remove any dirt or debris.
7. Dry the udder and teat with dry towel
8. Sit on a milking stool or bench near the cow's udder.
9. Before milking each cow, take a small amount of milk from each teat by gently squeeze and strip the teat, allowing a small amount of milk to flow into the strip cup.
10. Shake and observe the milk sample closely for any signs presence of clumps or clots, discolored or has an abnormal hue and watery, or contains flakes.
11. If mastitis is suspected based on the strip cup examination, it is important to take appropriate measures. Separate the cow with mastitis from the rest of the herd to prevent the spread of infection. Contact a veterinarian with expertise in dairy herd health treatment.
12. Wash your hand and start milking mastitis free cow by grasping the base of the teats firmly with your fingers and thumb, forming a tight seal around each teat. Using a rhythmic squeezing motion, apply pressure from the base of the teats towards the tip, forcing the milk to flow out.
13. Continue milking one teat at a time, maintaining a steady rhythm and pressure and ensure that the milk flows directly into a clean milking bucket.
14. Once milking is complete, apply a post-milking teat dip or spray to help prevent infections and promote udder health
15. Release the cow from the restraining device if applicable.
16. After milking, thoroughly clean and sanitize all milking equipment

Precautions

- Starting milking mastitis affected cow after complete mastitis free cows
- Dispose the milk that contain mastitis
- First milking heifers to prevent mastitis spread to heifers because heifers easily affected than cows

4.2.2. Machine milking

Machine milking is a common method used for milking cows on dairy farms. It involves using a milking machine that is specifically designed to extract milk from the cow's udder.



Figure 33. Single bucket portable milking machine Figure 34. Double bucket portable milking machine

Practical activity-15	Perform machine milking
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A. Resource required

- Moist towel: The moist towel is used to clean the cow's udder and teats before milking.
- Dry towel: The dry towel is used to dry the udder after cleaning, ensuring a clean and dry surface for attaching the milking machine.
- Teat disinfectant: To disinfect the teats after milking
- Strip cup: The strip cup is used to detect any abnormalities in the milk, such as clots, flakes, or changes in color or consistency, which could indicate the presence of mastitis.
- Sanitizer: The sanitizer is used for cleaning and sanitizing milking equipment and surfaces to kill bacteria and reduce the risk of contamination during the milking process.
- Milking machine: A milking machine is a device specially designed for extracting milk from cows or other dairy animals. It typically consists of the following components:

B. Machine milking procedure

1. Wear personal protective equipment.
2. Clean the milking parlor or area to maintain hygiene.
3. Wash and sanitize your hands before milking.

4. Bring the cow into the milking area or parlor.
5. Wash your hand
6. Clean the udder and teat with warm water by using towels to remove dirt and debris from udder.
7. Dry the teats thoroughly to prevent bacteria from entering the udder by using dry towel
8. Check mastitis
9. Assemble the milking machine according to the manufacturer's instructions.
10. Ensure that all parts, such as the vacuum pump, pulsator, milk lines, and teat cups, are clean and in good working condition.
11. Connect the milk lines to the milk collection system or storage tank.
12. Attach the teat cups to each teat of the cow and ensure a secure and airtight seal between the teat cups and the teats.
13. Start the milking machine, which activates the vacuum pump and pulsator.
14. Observe the milking process to ensure that milk flow is consistent and that each teat is being milked properly.
15. Once the milk flow slows down significantly, indicating that the cow is almost milked out, the teat cups can be removed.
16. After milking, clean the cow's teats again with a post-milking teat dip or spray to disinfect and protect against bacterial infections.
17. Release cows from milking area or parlor.
18. Thoroughly clean and sanitize the milking machine and components after each milking session.

Self-check questions -15	Written test
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Write short answer accordingly

1. Mention 2 types of milking methods
2. Write at list 5 resources used for hand milking dairy cows

Unit Summary

Hand milking is the traditional method of extracting milk from dairy animals, such as cows, goats, or sheep. It involves manually squeezing and pulling the teats of the animal to release the milk into a bucket or container. Hand milking requires a skilled person who uses their hands and fingers to apply pressure and rhythmically extract the milk. It is a labor-intensive process that demands physical strength and dexterity. Hand milking is commonly practiced in small-scale farming operations or in areas with limited access to electricity or modern milking equipment.

Machine milking, also known as mechanical milking or milking automation, is a modern method of extracting milk from dairy animals. Machine milking is efficient, time-saving, and reduces the physical strain on the milker. It is widely used in large-scale dairy operations, where multiple animals are milked simultaneously using automated systems.

Unit Review Questions

1. Which of the following is a common physical injury hazard on a dairy farm?

- | | |
|----------------------------------|-----------------------------------|
| A. Exposure to zoonotic diseases | C. Slip, trip, and fall accidents |
| B. Chemical exposure | D. Electrical hazards |

2. What is a recommended measure to mitigate electrical hazards on a dairy farm?

- | | |
|---|--|
| A. Using chemicals for crop management | C. Handling medications according to safety guidelines |
| B. Proper grounding of electrical systems | D. Wearing personal protective equipment |

3. Which of the following is a zoonotic disease that dairy workers may be at risk of contracting?

- | | |
|---------------------------|------------------------|
| A. Brucellosis | C. Avian influenza |
| B. Foot-and-mouth disease | D. African swine fever |

4. What is one potential risk of improper handling or exposure to chemicals used in cleaning milking equipment?

- | | |
|-----------------------|---------------------------------|
| A. Respiratory issues | C. Allergic reactions to pollen |
| B. Heatstroke | D. Risk of developing malaria |

5. Which milking method involves manually extracting milk from lactating animal using hands?

- A. Machine milking
B. Automated milking
C. Hand milking
D. All

6. Which of the following is a characteristic of hand milking?

- A. It uses of a vacuum system.
B. Commonly used in large-scale commercial dairy farms.
C. It is a labor-intensive technique.
D. It allows for simultaneous milking of multiple animals.

7. Machine milking is commonly used in:

- A. Small-scale organic dairy farms
B. Traditional bucket milking operations
C. Large commercial dairy farms
D. Hand milking practices

Answer key for self-check questions

Self-check questions -14

1. E 2. B 3. C 4. D

Self-check questions -15

1. Hand milking, machine milking
2. Milk bucket, strip cup, disinfectant, milk store tank, and milk Strainer

Project Work

LAP TEST 4

Perform dairy cattle milking operation

Instructions: Visit one dairy farm that milking their cows by machine and also other one dairy farm that only milking their cow by hand to do the following tasks. Given necessary templates, tools and materials you are required to perform the following tasks within **4** hours.

Task- 1. Write how the farm you visited mitigate hazards

Task-2. Perform hand milking

Task-3. Perform machine milking

UNIT 5

Dairy Cattle Breeding

Learning outcomes

At the end of this unit, the students will be able

- Identify dairy cattle breeds
- Select dairy cattle breeds
- Select breeding system
- Perform heat detection
- Perform mating procedures and handling techniques

Key terms

- Breed
- Mating
- Heat

Unit Introduction

What are the key factors to consider when selecting breeding stock for a dairy cattle herd, and how can those factors contribute to overall herd productivity?

A dairy cattle breeding is a vital component of the dairy industry, focusing on improving the quality and productivity of dairy cows. It involves identifying and selecting suitable dairy cattle breeds based on specific traits and objectives. By implementing appropriate breeding systems, performing accurate heat detection, and employing effective mating procedures and handling techniques, farmers can enhance milk production. These practices contribute to the development of and high-yielding dairy cattle, aligning with industry demands and ensuring profitability.

5.1. Dairy Cattle Breeds

Dairy cattle breeds are specific types of cattle that have been selectively bred over generations to excel in milk production and meet the needs of the dairy industry. There are several prominent dairy cattle breeds


worldwide, each with its unique characteristics and advantages. These breeds have been developed over time to maximize milk production and overall dairy productivity.




5.1.1 Indigenous dairy cattle breeds


Indigenous cattle breeds are cattle breeds that have developed and adapted to specific regions over a long period of time. These breeds have evolved in response to the local climatic, ecological, and agricultural conditions, making them well-suited to thrive in their respective environments. Indigenous breeds often possess unique traits and characteristics that make them valuable for local farming systems and contribute to the agricultural heritage of a particular region or country.

In the case of Ethiopia, the country is home to several indigenous cattle breeds that have adapted to the diverse landscapes and climates found within its borders. These breeds have been shaped by the specific environmental challenges and agricultural practices of their respective regions. Common indigenous cattle breed in Ethiopia are listed below:

Table 15: Indigenous cattle breeds in Ethiopia

Breeds	Description	Picture
Boran	Southern - Adaptability, disease resistance, thrive on low-quality forage, various coat colors (red, black, white)	


Breeds	Description	Picture
Arsi	Arsi Zone - High milk production, good meat quality, tolerance to harsh environmental conditions, reddish-brown coat color	
Fogera	Fogera - High milk production, good draught power, resistance to trypanosomiasis, adapted to wet and humid conditions	
Horro	Horro Guduru - Good milk production, adaptability, resistance to diseases, suitable for tropical highland and lowland areas	





Breeds	Description	Picture
Sheko	Sheko Zone - Good milk production, ability to graze in forested areas, resistance to ticks and tick-borne diseases, adapted to humid and forested regions	


5.1.2. Exotic dairy cattle breeds

Exotic breeds, in the context of livestock, refer to animal breeds that are not native to a particular region but have been introduced from other parts of the world. These breeds are often selected and imported for specific purposes, such as improving productivity, introducing new traits, or meeting specific market demands. Exotic breeds are typically chosen for their desirable characteristics, which can include higher milk or meat production, adaptability to specific climates or environments, disease resistance, or unique physical features. These breeds may possess traits that are not commonly found in the local or indigenous breeds of a region.

Table 16: Exotic dairy cattle breeds

Breed	Descriptions	Picture
Holstein Friesian	Netherlands, High milk production, adaptability, black-and-white or red-and-white coat colors	

Breed	Descriptions	Picture
Jersey	Channel Islands, High butterfat content, small stature, fawn coloration	
Guernsey	Channel Islands, Golden milk with high beta-carotene, adaptability, reddish-brown and white coat	
Brown Swiss	Switzerland, Large size, brown coat, high milk yield with good butterfat content	
Ayrshire	Scotland, Adaptability, efficient conversion of forage into milk, red and white coat	

Breed	Descriptions	Picture
Milking Shorthorn	England, Dual-purpose capabilities, adaptability, various coat colors	

Self-check question -16	Written test
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Write short answer accordingly

1. Write at least 4 indigenous dairy cattle breeds
2. Write at least 5 exotic dairy cattle breeds

5.2. Dairy Cattle Selection

Dairy cattle selection is a critical aspect of managing a successful dairy herd. By strategically choosing which animals to breed and focusing on specific traits, farmers can improve overall herd productivity. The selection criteria can be taken into account for dairy cattle operation includes:

1. Production Traits

The primary consideration is the animal's milk production capabilities. Factors to assess milk production include milk yield (measured in liters), milk composition (fat and protein content), and lactation length (the ability to sustain milk production as per standard period).

2. Conformation

Conformation refers to the physical structure and appearance of the cow. Dairy cattle with desirable conformation traits, such as a well-attached and proportionate udder, strong feet and legs, adequate body capacity, and correct skeletal alignment. Proper conformation is crucial for efficient milk production and the long-term health and longevity of the animal.

Judging the conformation aspect of dairy cattle

A. Udder and teat conformation traits

Udder conformation traits play a crucial role in evaluating the udder quality of dairy cattle. The udder is assigned the highest weight 40% - 50% as it is a crucial trait directly related to milk production and functionality. It includes factors such as udder attachment, udder depth, teat placement, teat size, and overall udder conformation. A well-attached and well-formed udder contributes to efficient milk production, ease of milking, and udder health. Conformation traits that related to udder characteristics include

Udder depth: Udder depth refers to the distance between the base of the udder and the body floor. A desirable udder depth is moderate, indicating a well-attached udder that is not too high or too close to the ground.

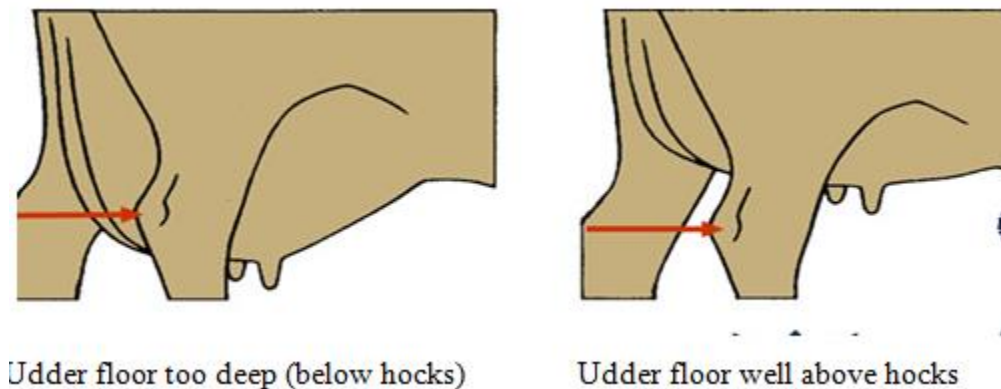


Figure 35 : Udder depth

Rear udder: The rear udder refers to the portion of the udder that is located behind the cow's back legs. A high and wide rear udder attachment is preferred, as it allows for better udder capacity and ease of milking.

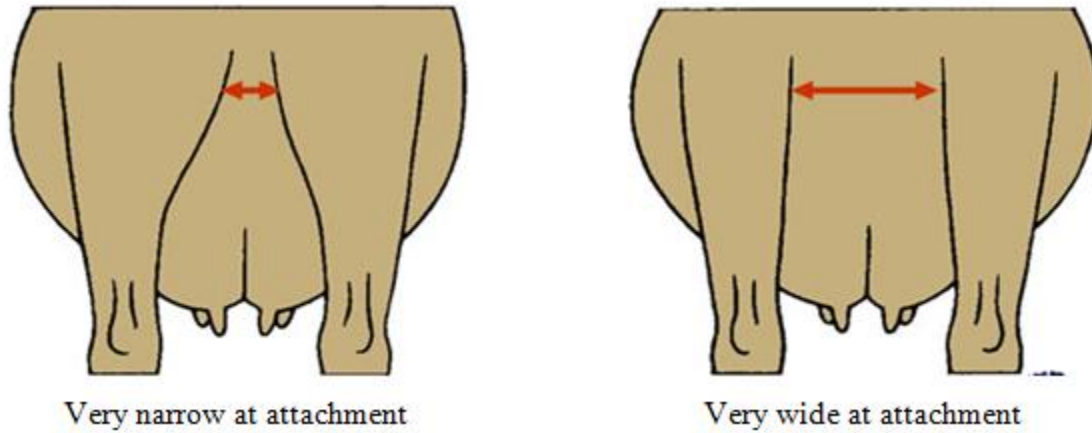


Figure 36: Rear udder attachment

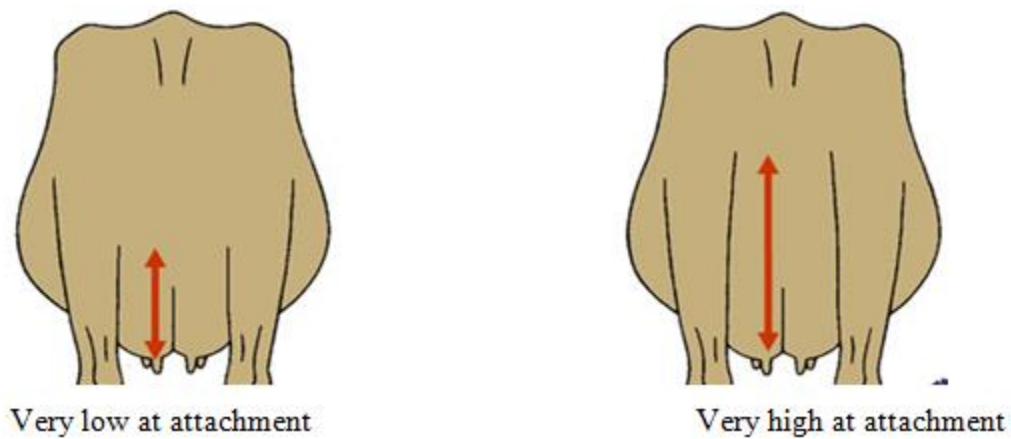


Figure 37: Rear udder height

Fore udder: The fore udder refers to the portion of the udder that is located in front of the cow's back legs. A long and smoothly attached fore udder is preferred, as it provides better udder balance and increased milk production capacity.

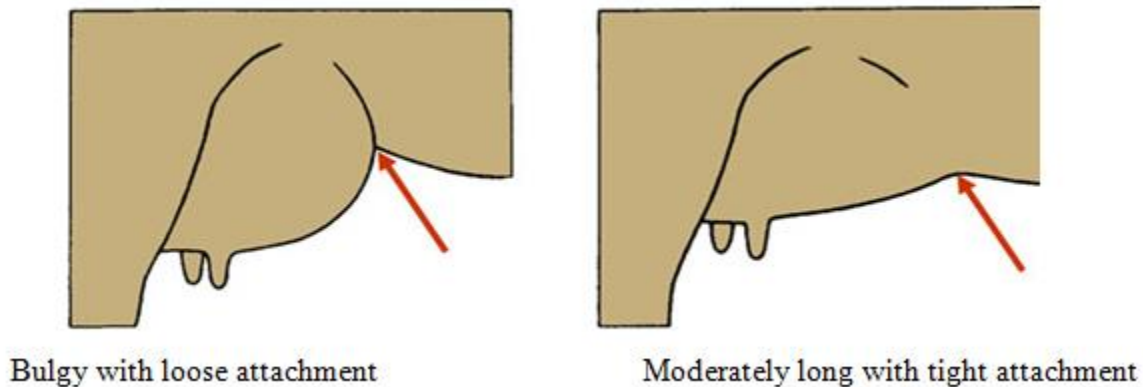


Figure 38: Fore udder attachment

Udder Cleft: The udder cleft is the division or separation between the left and right halves of the udder. A well-defined and open udder cleft is desirable, as it indicates better udder support and ease of attachment.

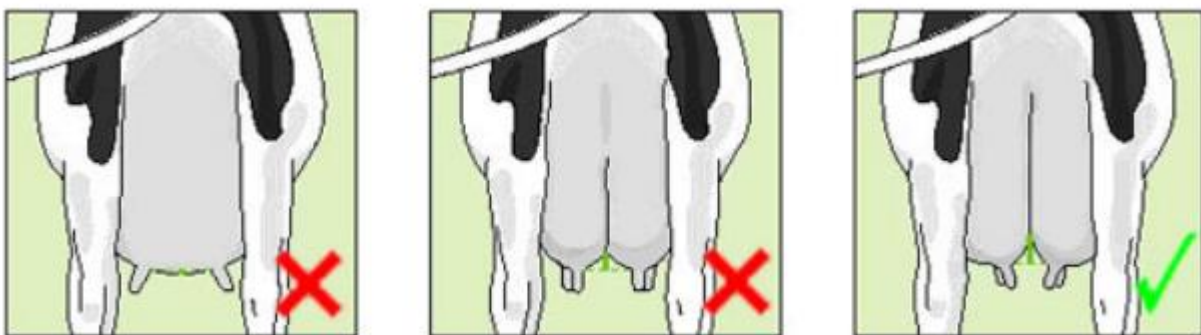


Figure 39: Udder Cleft

Udder Balance: Udder balance refers to the overall symmetry and proportionality of the udder when viewed from various angles. It involves evaluating the udder's shape, attachment, and positioning in relation to the cow's body. A well-balanced udder should be centered, evenly divided, and have consistent shape and size between the left and right halves. Udder balance is important for milk production efficiency, udder health, and calf accessibility during suckling.

Teats: The teats themselves should be of adequate size, well-formed, and properly attached to the udder. Well-developed teats facilitate efficient milking and reduce the risk of teat damage or infection.

Teat Placement: Teat placement refers to the positioning of the teats on the udder. Ideally, the teats should be evenly spaced and point downwards. Proper teat placement allows for easier milking and reduces the risk of injury or teat-related issues.

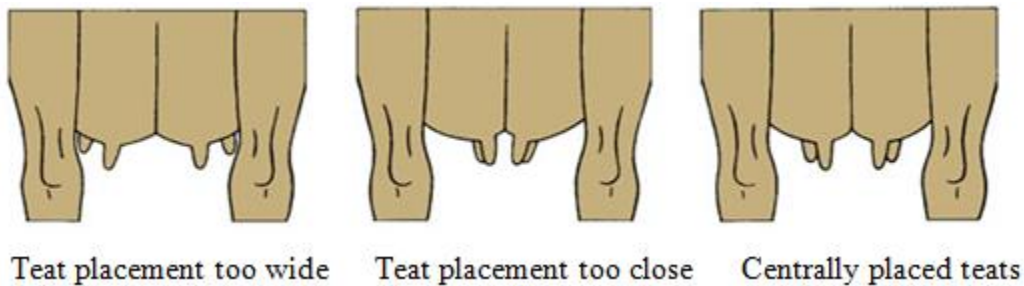


Figure 40: Teat placement

B. Front feet and legs conformation

Leg conformation is assigned a significant weight, typically accounting for 30% to 40% of the overall evaluation. It affects the cow's mobility, soundness, and overall longevity. It evaluates the structure and quality of the cow's feet and legs. Factors considered include foot angle, bone quality, pastern strength, and overall leg structure. Proper leg conformation allows for smooth movement, weight-bearing ability, and reduced risk of lameness. Good leg conformation ensures that the cow can walk, stand, and graze comfortably, which is crucial for overall health and productivity.

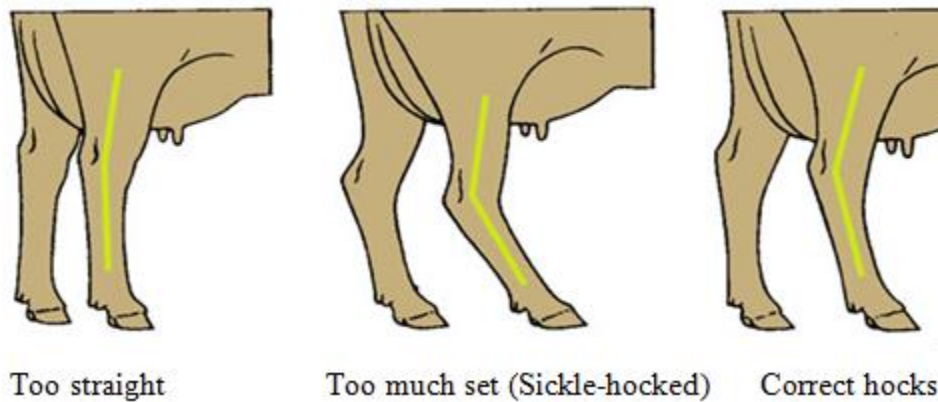


Figure 41: Hocks conformation

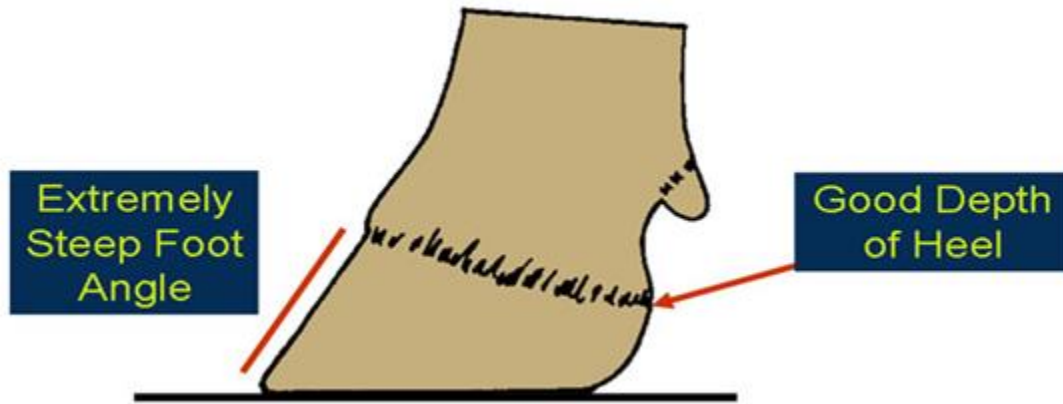


Figure 42: Excellent foot angle and depth of heel

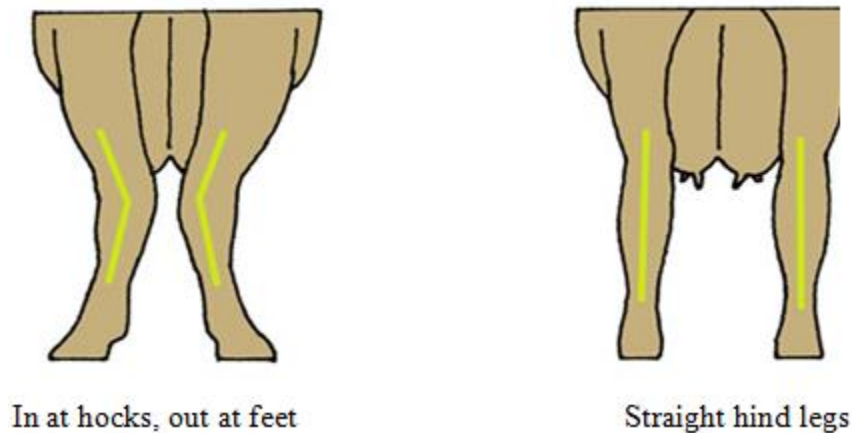


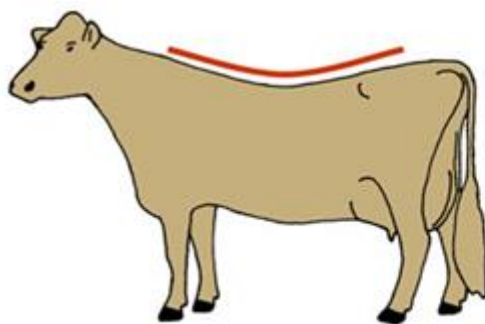
Figure 43: Hind leg rear view

C. Frame conformation

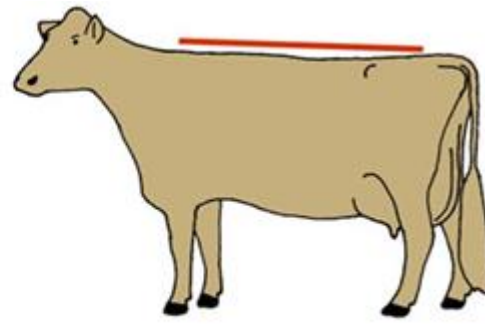
Frame conformation typically accounts for 20% to 30% of the overall evaluation. It refers to the overall body structure and proportions of the cow. Frame conformation influences the cow's body capacity, feed intake, and the ability to carry weight. A well-structured frame provides room for a functional rumen, sufficient feed intake, and proper body condition. It also contributes to the cow's ability to maintain productivity and adapt to different management systems. Key aspects of frame conformation to consider:

- **Body size:** Dairy cows should have a balanced and moderate body size. They should not be excessively large or small. A well-sized body allows for adequate feed intake and efficient milk production.

- Chest width: A broad and well-developed chest allows for proper lung capacity, which is important for respiratory health and efficient oxygen exchange. It also provides ample room for the rumen, promoting healthy digestion.
- Body depth: The cow's body should exhibit appropriate depth, providing ample space for rumen expansion and allowing for a higher feed intake. This promotes good rumen function and overall feed efficiency.
- Rib spring: A desirable dairy cow frame should have well-sprung ribs. This means the ribs should be wide apart, allowing for a spacious rumen and accommodating an optimal feed capacity.
- Rump: The rump, or hindquarters, should be wide, well-developed, level, and display good muscling. It provides a solid base for the cow's body and contributes to locomotion, balance, and milk production potential.
- Loin strength: The loin area, located between the ribs and the pelvis, should be strong and well-muscled. A robust loin supports the cow's back and facilitates efficient movement and posture.
- Straightness (angularity): Dairy cows typically exhibit angularity, characterized by a clean and sharp appearance in the shoulders, with distinct withers and a refined neck. Angularity is associated with enhanced milk production and overall dairy quality.



Sway-backed and lacks balance



Straight lines and well balance

Figure 44: Straightness (angularity)

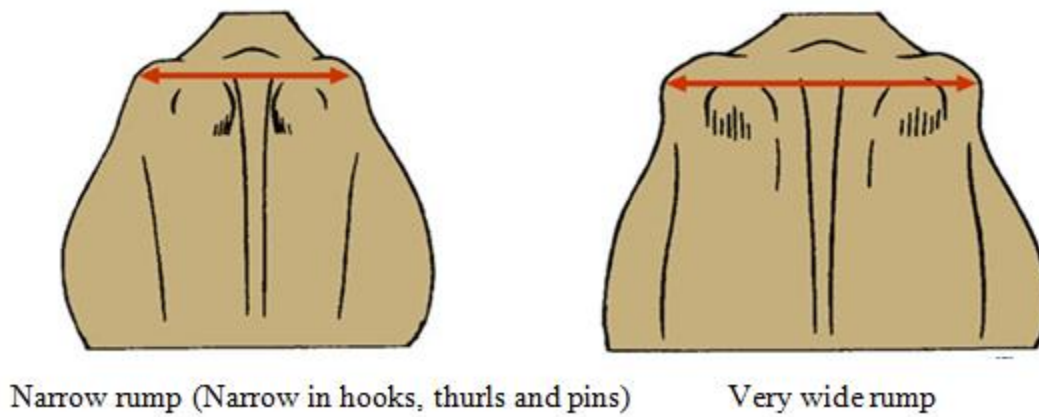


Figure 45: Rump width

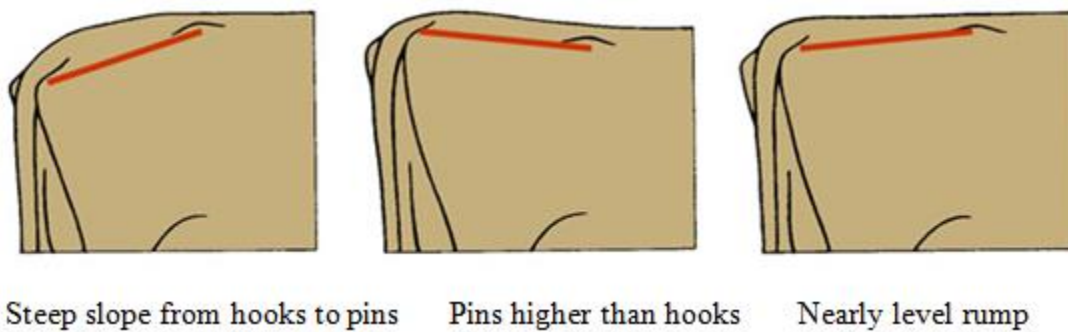


Figure 49: Rump slope

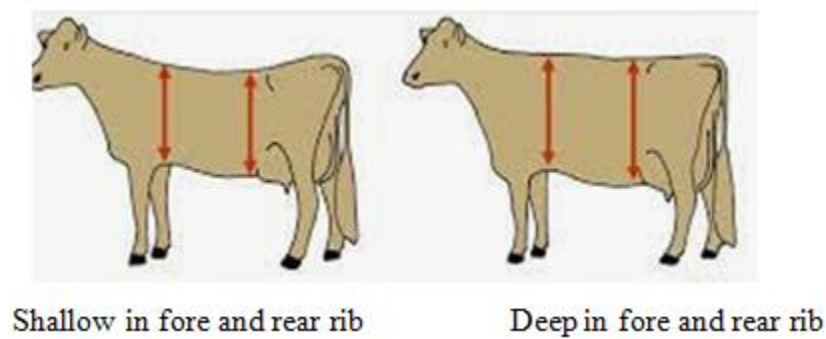


Figure 50: Shallow and deep rib

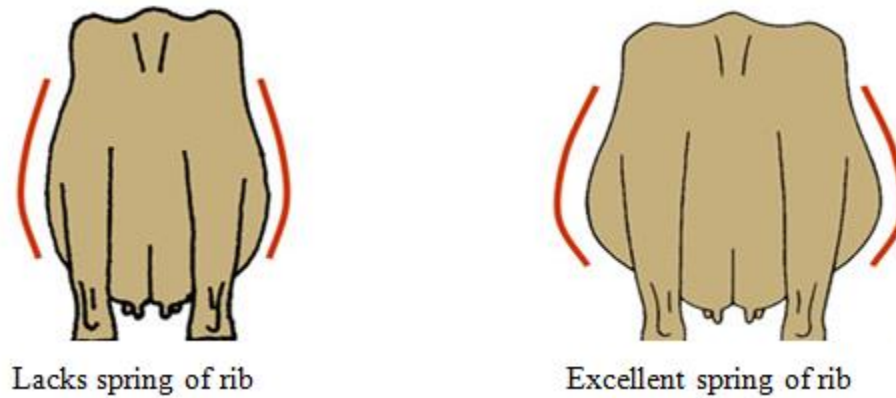


Figure 51: Lacks spring and excellent spring rib

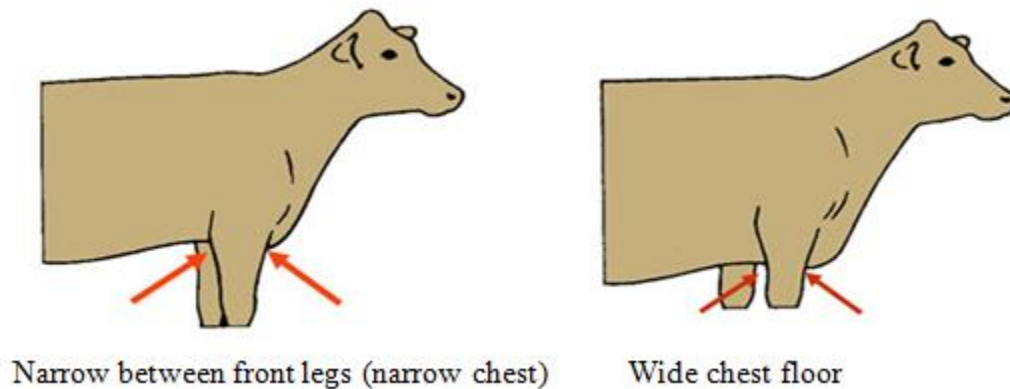


Figure 52: Narrow and wide chest

3. Health and disease resistance

It is important to assess the health history of the animal and its lineage. Look for animals with a track record of good overall health and resistance to common diseases. Cattle with strong immune systems and resistance to prevalent diseases will require fewer veterinary interventions and are less likely to experience production losses.

4. Reproductive performance

Factors such as the age at first calving, calving interval, and fertility rates should be considered. Selecting animals with good reproductive efficiency is crucial, as it directly impacts the overall productivity and profitability of the herd.

- **Age at first calving:** Age at first calving" refers to the age at which a heifer gives birth to her first calf. The age at first calving for dairy cattle typically ranges from 22 to 24 months. The age at first calving is influenced by several factors, including breed, genetics, nutrition, and management practices.
- **Calving interval:** The calving interval in dairy cattle refers to the time period between consecutive calving. It is an important measure of reproductive efficiency and impacts the overall productivity of the herd. The ideal calving interval for dairy cattle is generally around 12 to 14 months. This allows cows to have sufficient time to recover, reproduce, and produce a consistent milk supply.
- **Fertility rates:** It refers to specific measures used to assess and quantify the reproductive performance and efficiency of cows within a dairy herd. These rates provide valuable information about the cows' ability to conceive, maintain pregnancies, and successfully give birth to live calves. Fertility rates in dairy cattle can be accessed through various parameters. Commonly used measures include:
 - ✓ **Conception rate:** The conception rate typically refers to the percentage of cows that become pregnant after a single insemination or breeding event. It is often measured within a specific heat cycle or estrous cycle, which is typically around 21 days in dairy cattle. It typically ranges from 30% to 50%, but can vary depending on factors such as breed, genetics, nutrition, and management practices.
 - ✓ **Pregnancy rate:** The pregnancy rate refers to the percentage of cows that become pregnant within a specific time period. It could be measured over a period of weeks, months, or even a full year. The pregnancy rate takes into account multiple breeding attempts and the overall chance of achieving pregnancy within the specified time period. The typical pregnancy rate for dairy cattle can range from 15% to 25%.
 - ✓ **Calving rate:** The calving rate measures the percentage of cows that successfully give birth to live calves within a specific time period, typically within a year. It considers the pregnancy rate and the number of cows that carry the pregnancy to term. A calving rate of 85% to 90% is considered desirable for dairy herds.

5. Temperament

The temperament of dairy cattle refers to their individual behavioral characteristics and responses to various situations. Cattle that exhibit calm and docile behavior and are easy to handle are safer for both the animals and the handlers. Key points should consider about temperament in dairy cattle:

- **Calm and gentle temperament:** Cattle with a calm and gentle temperament are generally easier to handle and less prone to stress or aggressive behavior. They are more cooperative during milking, handling,

and other management procedures. Calm cows are less likely to exhibit behaviors such as kicking, charging, or resisting during milking or veterinary procedures.

- **Flighty or aggressive temperament:** Some cattle may have a more flighty or aggressive temperament, which can make handling and management more challenging. These animals may be more prone to stress, difficulty in milking, and potential safety risks for both the cattle and the handlers. Flighty cattle may be more reactive to stimuli and easily frightened or startled.
- **Individual variation:** It's important to note that temperament can vary among individual cattle, even within the same herd or breed. Some cattle may naturally be more docile and easier to handle, while others might be more reactive or nervous. This variation can be influenced by genetics, early handling experiences, and overall socialization.
- **Handling and socialization:** Proper handling and socialization of dairy cattle from a young age can play a significant role in shaping their temperament. Regular, gentle, and positive interactions with humans can help build trust and reduce anxiety. Early socialization with other animals and exposure to various environmental stimuli can also contribute to a calmer and adaptable temperament.

6. Environmental adaptability

Consideration may be given to the ability of cattle to adapt to specific environmental conditions, such as heat tolerance, cold tolerance, or resistance to specific diseases prevalent in the region. When selecting dairy cattle based on their environmental adaptability, specific factors to be considered include:

- **Climate suitability:** Choose breeds or individuals that are well-suited to the climate conditions prevalent in your region. For example, if you live in a hot and humid climate, consider breeds known for their heat tolerance and ability to cope with heat stress. Similarly, if you are in a cold climate, select breeds that have adaptations for cold weather.
- **Disease resistance:** Consider the prevalence of specific diseases in your region and select animals that have demonstrated resistance or tolerance to those diseases. This can help reduce the incidence of health issues and the need for excessive medical interventions.

Practical activity-2	Select dairy cattle by body conformation
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A. Resource required

- Checklist
- Reference materials

- Documented data about the history of the cows

B. Procedure

1. Prepare checklist: These forms will help you record and compare the conformation of different animals.
2. Take the time to observe the cattle you are considering. Look at their overall appearance, body structure, and movement. Pay attention frame size, angularity, and the soundness of their feet and legs.
3. Assess the udder conformation, including its shape, attachment, and overall health. Look for a well-attached udder with a strong suspensory system and proper teat placement and size.
4. Assess health, reproductive performance and temperament through observing the cows and take the documented history of the cows especially regard to reproductive performance
5. Use the evaluation forms and compare the scores of different animals to determine which ones meet your desired conformation standards.
6. Rank the animals based on their overall conformation and how well they align with your production objectives.
7. Based on the evaluation and ranking, choose the animals that best meet your production goals and exhibit the desired body conformation traits

Self-check question -17	Written test
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Write correct answer accordingly

1. Write at least 5 (five) general selection criteria that commonly used for dairy cattle
2. Write at least 5 (five) conformation traits that related to udder characteristics

5.3. Breeding System

The breeding system for dairy cattle refers to the approach and strategies used to selectively mate and propagate individuals within a dairy cattle population. The goal of dairy cattle breeding is to improve milk production, reproductive efficiency, health, and other desirable traits in the offspring. There are several breeding systems commonly employed in the dairy industry. Some of the main ones are the following;

Natural Mating: In natural mating, cows are allowed to mate freely with a bull or multiple bulls. This method allows for natural selection and genetic diversity within the population. However, it may be challenging to control the genetic composition of the offspring, and there is a risk of introducing undesirable traits or diseases

Artificial Insemination (AI): AI involves the collection of semen from carefully selected bulls and manually inseminating cows. This method allows for controlled and strategic mating, ensuring that high-quality genetics are passed on to the next generation. AI offers several advantages, such as increased genetic diversity, disease control, and the ability to use superior bulls that may be geographically distant.

Selective Breeding: Selective breeding involves carefully selecting and mating individuals based on their desirable traits and genetic potential. This approach often involves the use of tools such as pedigree analysis, performance recording, and genetic evaluations to identify superior animals for breeding. By selecting for specific traits like milk production, fertility, or disease resistance, farmers can gradually improve the overall quality of their herd.

- Pedigree analysis is an important tool in selective breeding. It involves studying the ancestry or genealogy of individuals to understand the inheritance patterns of specific traits. By analyzing pedigrees, breeders can identify individuals with superior traits and determine the likelihood of those traits being passed on to future generations.
- Performance recording is another crucial aspect of selective breeding. Breeders collect data on various performance traits, such as growth rate, milk production, disease resistance, or other desirable characteristics, depending on the species. This data is used to evaluate the performance of individuals and their offspring. By selecting animals with the best performance records, breeders can improve the overall quality of the population.
- Genetic evaluations, often using advanced statistical methods, are conducted to estimate the genetic value of individuals for specific traits. These evaluations take into account pedigree information and performance records, along with genetic markers or genotypic data if available. By combining these factors, breeders can make more accurate predictions about an individual's breeding value and potential to pass on desirable traits to future generations.

The combination of pedigree analysis, performance recording, and genetic evaluations allows breeders to make informed decisions when selecting breeding pairs. The goal is to increase the frequency of desirable genes within a population while reducing the occurrence of undesirable genes.

Self-check question -18	Written test
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Write short answer for the following questions

1. What is the purpose of a breeding system in dairy cattle?
2. Write at least 3 dairy cattle breeding systems

5.4. Heat Detection

Estrus, also known as heat, is the period of sexual receptivity in female dairy cattle when they are most fertile and receptive to mating or artificial insemination. Heat detection is the process of identifying and determining when a cow is in estrus, allowing for optimal timing of breeding or insemination. Accurate heat detection is crucial for successful reproduction and maximizing the conception rates in dairy cattle.

Common signs of heat to look for:

- Increased activity and restlessness: A cow in heat may exhibit increased activity levels, restless behavior, and appear more alert than usual. She may be seen walking or running around the herd more frequently.
- Mounting behavior: Cows in heat may engage in mounting behavior, where they mount or allow other cows to mount them. This behavior is more commonly observed when cows are in the presence of a bull or other cows in heat.
- Standing to be mounted: When a cow stands still and allows other cows or a bull to mount her, it is a strong indication that she is in heat. This behavior is known as standing heat.
- Swollen and reddened vulva: The vulva of a cow in heat may appear swollen and reddened compared to its normal state. This change is a result of increased blood flow to the reproductive organs.
- Mucus discharge: A thick, stringy, or sticky mucus discharge from the vulva can be observed during the estrus phase of the reproductive cycle. This discharge is often accompanied by other signs of heat, such as swelling and reddening of the vulva. Increased mucus production is a natural response of the reproductive tract to prepare for potential mating.
- Increased vocalization: Some cows may vocalize more frequently or differently during heat. They may bellow or make distinctive mating calls to attract a bull or other cows.
- Increased sniffing and licking: Cows in heat may exhibit increased interest in other cows and may engage in sniffing or licking behavior towards them, especially around the genital area.

- Changes in eating and rumination patterns: Some cows may experience a decrease in appetite or a temporary drop in milk production during heat. However, these changes can vary among individuals. Typically, cows come into heat or estrus every 18 to 24 days, with the average duration of heat lasting around 12 to 18 hours. Insemination is usually recommended around 12 to 18 hours after the onset of estrus. This timing allows for the best chance of successful fertilization when the cow's reproductive tract is most receptive to sperm. It's important to note that the timing may vary depending on the individual cow, so closely monitoring estrus signs is crucial. A common guideline is to observe cows for signs of heat at least three times per day.

The best times to detect heat in cows are typically during periods when cows are most active or when they are more likely to exhibit signs of heat. These key observation times include:

- Morning: Early morning hours, shortly after sunrise, are often an optimal time to observe cows for signs of heat. Cows tend to be more active during this time, and any behavioral or physical changes associated with heat may be more noticeable.
- Late Afternoon: Another recommended observation time is in the late afternoon or early evening. Cows may exhibit increased activity and show signs of heat during this time.
- Nighttime Observation: Cows can display signs of heat during the night, and observing them during this period can help ensure heat detection coverage throughout the day. Here are some methods and signs used for heat detection in dairy cattle:



Figure 46: Mounting behavior



Figure 47: Standing heat



Figure 48: Vulva swollen



Figure 49: Vulva mucus discharge



Figure 50: Increased sniffing and licking



Figure 51: Increased vocalization

Practical activity-16	Detect heat
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A. Resource required

- Heat detection aids: These aids are designed to help identify signs of heat in cows. Examples include:
Tail paint or chalk: A brightly colored paint or chalk that is applied to the tail head of cows. When other cows mount the marked cow, the paint or chalk gets rubbed off, indicating potential heat activity.
- Heat detection chart or record book: A record-keeping tool to note observations of each cow's behavior, including mounting, standing to be mounted, increased vocalization, restlessness, and discharge.

B. Procedure

Through visual observation:

1. Regularly observe the cows for signs of heat
2. Maintain a consistent schedule for observation, ideally multiple times per day, to increase the chances of detecting cows in heat.
3. Keep accurate records of observed heat events, including dates and identification numbers of the cows.

With heat detection aids:

1. Apply tail chalk or paint to the tail head of cows to easily identify mounting behavior.
2. Check for rubbed-off chalk or paint, indicating mounting activity.
3. Keep record to document heat dates.
4. Regularly update and analyze the records to identify heat patterns

Self-check question -19	Written test
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Write short answer accordingly

1. Define heat or estrus
2. Write at least 4 sign of heat

5.5. Mating Procedures and Handling Techniques

Mating procedures and handling techniques for dairy cattle" refers to the specific practices and approaches used to manage and facilitate the reproductive process in dairy cows. These procedures and techniques are designed to maximize reproductive success, genetic improvement, and overall herd productivity.

Mating procedures involve the process of pairing or breeding cows with bulls or using artificial insemination (AI) to facilitate reproduction.

Handling techniques refer to the appropriate and safe management of cows during mating and reproductive procedures. Ensuring gentle and calm handling of cows to minimize stress, prevent injuries, and maintain their overall well-being.

Practical activity-17	Natural mating procedures and handling techniques
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A. Resources required

- Breeding chute or pen: A sturdy and well-designed breeding chute or pen is essential for safely restraining the cow and bull during the mating process. It should provide sufficient space for the animals to move comfortably while minimizing the risk of injury.
- Halter and lead rope: These are used to handle and lead the bull during breeding. A strong and properly fitted halter and lead rope ensure control and safety during mating.
- Breeding record forms: Keeping accurate breeding records is important for effective reproductive management.

B. Procedure

1. Regularly observe cow behavior for signs of heat, such as increased activity, mounting other cows, vocalization, standing to be mounted, and mucus discharge.
2. Utilize heat detection aids, such as tail paint, chin ball markers, or activity monitoring devices, to assist in accurate heat detection.
3. Provide safe handling facilities, such as breeding pens, to control mating behavior and prevent injuries.
4. Bring the bull to cow and Observe bull behavior and remove any aggressive or unsuitable bulls from the breeding area.
5. Identify pregnant cows and record the pregnancy status.
6. If a cow is not pregnant, apply re-mating when the cow come to heat again
7. Maintain accurate and detailed records of breeding dates, heat detection and etc.

1. Write at least 3 resources used for handling during natural mating

Self-check question -20	Written test
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2. What is the advantage of performing cow handling techniques during mating?

Unit Summary

A dairy cattle breeding is crucial for improving the quality and productivity of dairy cows in the industry. It involves selecting suitable breeds, implementing effective breeding systems, accurate heat detection, and proper mating procedures. The goal is to optimize milk production and traits such as milk composition, fertility, longevity, and disease resistance. Breed selection, breeding systems, heat detection, and mating procedures are key aspects. Genetic progress is achieved by choosing superior sires and dams with desirable traits. Improving milk composition, longevity, and disease resistance are also important objectives. By employing these practices and monitoring herd performance, farmers can maximize production potential and meet industry demands.

Unit Review Questions

1. Exotic dairy cattle breeds are known for their:

- | | |
|---|---|
| A. Adaptation to local environments and specific traits | C. Unique genetic characteristics and milk production potential |
| B. High fertility rates and disease resistance | D. Native origin and historical significance |

2. Indigenous dairy cattle breeds are characterized by their:

- | | |
|---|--|
| A. High milk production and large size | C. Low fertility rates and high disease susceptibility |
| B. Adaptation to local environments and specific traits | D. Exotic origin and foreign genetic influence |

3. The development of indigenous cattle breeds is influenced by:

- | | |
|--|--|
| A. Local climatic and ecological conditions | D. Artificial insemination and reproductive technologies |
| B. Genetic modification and selective breeding | |
| C. Crossbreeding with exotic breeds | |

4. Which of the following signs is commonly observed in dairy cows during heat?

-
- A. Increased milk production
B. Decreased appetite
- C. Restlessness and mounting other cows
D. Elevated body temperature
4. Which method of heat detection involves observing changes in the cow's vaginal mucus?
- A. Visual observation
B. Electronic heat detection devices
- C. Hormone level monitoring
D. Rectal palpation
5. Proper handling techniques for dairy cows during mating and reproductive procedures aim to:
- A. Maximize milk production
B. Minimize stress and injuries
- C. Increase fertility rates
D. Enhance genetic improvement
6. Which of the following udder conformation traits is important for udder health and calf accessibility during suckling?
- A. Well-defined udder cleft
B. High and wide rear udder attachment
- C. Long and smoothly attached fore udder
D. Adequate teat size
7. What is the preferred positioning of teats on the udder for easier milking and reduced risk of teat-related issues?
- A. Evenly spaced and pointing upwards
B. Evenly spaced and pointing downwards
- C. Close together and pointing upwards
D. Wide apart and pointing downwards
8. What is the typical age range for first calving in dairy cattle?
- A. 12 to 14 months
B. 18 to 20 months
C. 22 to 24 months
D. 28 to 30 months

Answer key for self-check questions

Self-check questions -16

1. Boran, Arsi, Fogera, Horro
2. Holstein, Jersey, Brown swiss, Ayrshire, Milking short horn

Self-check questions -17

1. Production, Conformation, Health and diseases resistance, Reproductive performance and Temperament
2. Udder depth, Rear udder, Fore udder, Udder cleft and udder balance

Self-check question -18

1. To improve milk production, reproductive efficiency, health, and other desirable traits in the offspring
2. Natural mating, Artificial insemination and selective breeding

Self-check questions -19

1. Estrus, also known as heat, is the period of sexual receptivity in female dairy cattle
2. Restlessness, mounting behavior, mucus discharge from the vulva, and swelling and reddening of the vulva

Self-check questions -20

1. Breeding chute or pen, halter and lead rope, breeding record forms
2. To minimize stress, prevent injuries, and maintain their overall well-being.

Project Work

LAP TEST 5	Detect heat and perform natural mating procedure
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Instructions: Visit one dairy farm and do the following tasks. Given necessary templates, tools and materials you are required to perform the following tasks within **3** hour. The project is expected from each student to do it.

Task 1. Perform heat detection

Task2. Perform natural mating procedure and handling techniques

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MODULE II

BASIC KAIZEN



Contents

No		Contents	page
		Module Description	118
1		UNIT 1: Basic Kaizen Concepts	119
	1.1	Introduction to Kaizen	119
	1.2	Principles of Kaizen philosophy	120
	1.3	Key Concepts of Continuous Improvement	122
	1.4	Benefits of Implementing Kaizen	125
		Unit Summary	127
		Unit Review Questions	128
2		Unit 2: Waste Identification and Elimination	130
	2.1	Introduction to Waste	131
	2.2	Types of Waste	132
	2.3	Understanding Waste in the Workplace	138
	2.4	Identifying and Eliminating Muda	144
	2.5	Continuous Improvement Mindset in Waste Reduction	147
		Unit Summary	148
		Unit Review Questions	149
3		Unit 3: 5S Procedure	152
	3.1	Meaning of 5S	152
	3.2	Benefit of Implementing 5S	155
	3.3	Relationship between 5S and Kaizen philosophy	156
	3.4	The 5S Phases	157
	3.5	Implementing and Sustaining 5S in the Workplace	176
		Unit Summary	179
		Unit Review Questions	181
		References	185

Module Description

This module equips students with the necessary knowledge, skills and mindset to understand and apply Kaizen principles effectively. It covers basic principles and importance of Kaizen, waste elimination, and the 5S methodology for workplace efficiency. Through practical exercises, students learn to identify and eradicate waste, ultimately preparing them to drive continuous improvement in future endeavors.

UNIT 1

Basic Kaizen Concepts

Learning outcome:

At the end of this unit, students will be able to:

- Understand meaning of Kaizen and its basic concept
- Understand origin of Kaizen
- Performing basic Kaizen Principles
- Recognize the benefit of Kaizen

Key terms:

- Kaizen
- Plan-Do-Check-Act Cycle (PDCA)
- Improvement

1.1 Introduction to Kaizen

Kaizen, originating from Japan, embodies the philosophy of continuous improvement. It emphasizes the relentless pursuit of small, incremental changes in processes, systems, and behaviors to achieve greater efficiency, quality, and effectiveness. The term "Kaizen" itself translates to "change" (kai) for the better (zen), reflecting its core principle of ongoing improvement. At its essence, Kaizen is not a one-time event or a grand overhaul but rather a daily practice ingrained in the culture of an organization. It involves the collective efforts of all employees, from top management to frontline workers, who are encouraged to identify problems, propose solutions, and implement improvements in their respective areas of work. Kaizen fosters a culture of innovation, empowerment, and continuous learning, where even the smallest improvements contribute to significant long-term gains. By embracing Kaizen, organizations strive to stay agile, adaptive, and competitive in a rapidly evolving world.

It is no surprise that agriculture has entered the elite club of industries that adapt and implement Kaizen. As a result, "factory" and "farm" are no longer distinct terms. Instead, Kaizen is distinguished by its distinctive approach, whether on farms or workplaces. A shift in thinking is required to bring about transformation. Farms are embracing Kaizen ideas, which has resulted in significant improvements in their operations, behavior, and activities.

The meaning of Kaizen

Kaizen is a Japanese term that translates to "continuous improvement" or "change for the better." It's a philosophy or methodology focused on making incremental improvements in processes, products, or services over time. Rather than seeking major, revolutionary changes, kaizen emphasizes small, gradual improvements that can be implemented by everyone in an organization. This approach encourages employees to constantly look for ways to streamline processes, reduce waste, and enhance quality, resulting in overall efficiency gains and a culture of continuous improvement within the organization. Kaizen is widely used in various industries around the world as a key element of lean manufacturing and management practices. Kaizen is continuous improvement that is based on certain guiding principles:

And much more! One of the most notable features of kaizen is that big results come from many small changes accumulated over time. However, this has been misunderstood to mean that kaizen equals small changes. In fact, kaizen means everyone involved in making improvements. While the majority of changes may be small, the greatest impact may be kaizens that are led by senior management as transformational projects, or by cross-functional teams as kaizen events.

1.2 Principles of Kaizen Philosophy

The principles of Kaizen philosophy encompass a set of fundamental beliefs and values that guide organizations in their pursuit of continuous improvement and excellence.



Figure 1: key principles of kaizen

These principles form the cornerstone of Kaizen implementation and are essential for fostering a culture of innovation, collaboration, and sustained growth. Here are the key principles of Kaizen:

- **Continuous Improvement:** Kaizen emphasizes the concept of continuous, incremental improvement in all aspects of operations, processes, and systems. It encourages livestock industries to constantly seek opportunities for enhancement, no matter how small, to achieve greater efficiency, quality, and customer satisfaction over time.
- **Respect for People:** Central to Kaizen is the belief that every individual within the organization possesses valuable insights, knowledge, and expertise. Therefore, Kaizen promotes a culture of mutual respect, trust, and empowerment, where employees are actively engaged, encouraged to voice their ideas, and given the autonomy to implement improvements.
- **Elimination of Waste:** Kaizen advocates for the identification and elimination of waste in all forms, including overproduction, waiting times, unnecessary motion, defects, and excess inventory. By reducing waste, organizations can streamline processes, optimize resource utilization, and enhance overall efficiency and productivity.
- **Standardization:** Standardization is essential for ensuring consistency, reliability, and repeatability in processes and operations. Kaizen encourages the establishment of standardized work procedures, protocols, and guidelines to maintain quality, reduce variability, and facilitate continuous improvement efforts.
- **Quality at the Source:** Kaizen promotes the principle of "quality at the source," which means identifying and addressing quality issues at their origin rather than detecting and correcting defects downstream. By instilling a culture of accountability and responsibility for quality among all employees, organizations can prevent errors, defects, and rework, thereby improving product and service quality.
- **Visual Management:** Visual management techniques, such as visual controls, signage, and displays, play a crucial role in Kaizen implementation by making information, processes, and performance indicators easily accessible and understandable to employees. Visual management tools help create transparency, facilitate communication, and support continuous monitoring and improvement efforts.

These principles serve as guiding principles for organizations or farms embarking on the Kaizen journey, helping them create a conducive environment for innovation, teamwork, and sustainable growth. By embracing these principles, organizations can foster a culture of continuous improvement, drive operational excellence, and achieve long-term success in today's dynamic and competitive business landscape.

Self-check questions 1

1. Describe the significance of continuous improvement in the context of Kaizen philosophy. How does it contribute to success of a commercial farm?
2. Explain the role of Toyota's Production System (TPS) in shaping the principles of Kaizen. How did TPS revolutionize manufacturing practices?
3. Identify and discuss three key principles of Kaizen philosophy outlined in the text. How do these principles contribute to fostering a culture of continuous improvement within organizations?
4. How does Kaizen promote employee empowerment and engagement in the improvement process? Provide examples of how employees can actively participate in Kaizen initiatives.

1.3 Key Concepts of Continuous Improvement

Continuous Improvement (CI) is an ongoing effort to improve products, services, or processes incrementally over time. It is a fundamental principle in various management philosophies, such as Total Quality Management (TQM) and Lean Management. Key concepts of continuous improvement include:

Incremental changes vs. radical improvements

- **Incremental Changes:** These are small, gradual adjustments made to existing processes, products, or services. They are often easier to implement and less disruptive to the organization.
- **Radical Improvements:** Also known as breakthrough improvements, these involve significant and transformative changes to processes or products. They can lead to substantial gains in efficiency, quality, or innovation but may require more resources and time to implement.

Criteria	Kaizen (Incremental Changes)	Innovation (Radical Improvements)
Effect	Long term not breakthrough	Short-term breakthrough
Steps	Small steps	Big steps
Team-work	Permanente action with gradual rising effects	Incidental action with immediate effect
Change	gradual and permanent	Sudden and single
engagement	All	Chosen leaders
Approach	Team effect, process approach	Individual ideas and actions

Criteria	Kaizen (Incremental Changes)	Innovation (Radical Improvements)
Work method	Maintenance and improvement	Extinguishing and rebuild
Ideas	Conventional knowhow and traditional technology	Usage of technology, breakthrough, new innovation and theory
Practical requirements	Small investment, big effort	Big investment, small effort
Orientation	For people	For technology
Assessment criteria	Process and engagement in achieving of better result	Result directly affect profits

The PDCA Cycle: A Blueprint for Continuous Improvement

The Plan-Do-Check-Act Cycle (PDCA Cycle) is a four-step model for systematic problem solving and continuous improvement. It offers a simple and structured way for resolving business-related issues and creating positive change. This framework is widely recognized as the basis for enhancing the quality of processes, products, and services by following a logical sequence of four steps: Plan, Do, Check, and Act.

The PDCA cycle model can be applied in most kinds of projects and improvement activities, whether they are breakthrough changes or smaller incremental enhancements. For example, it can be effectively utilized when aiming to enhance employee skill levels within an organization, change the supplier of a product or service, or increase the quality of care and patient engagement within a hospital.

A common practical example of the PDCA cycle can be illustrated when dealing with customer complaints. This scenario involves steps like reviewing, categorizing, and prioritizing the existing complaints, generating potential solutions for addressing the most frequent complaints, conducting pilot surveys with sample customers to test new options, collecting and analyzing customer data and feedback, and ultimately implementing lessons learned on a larger scale. The above steps represent the PDCA cycle in action

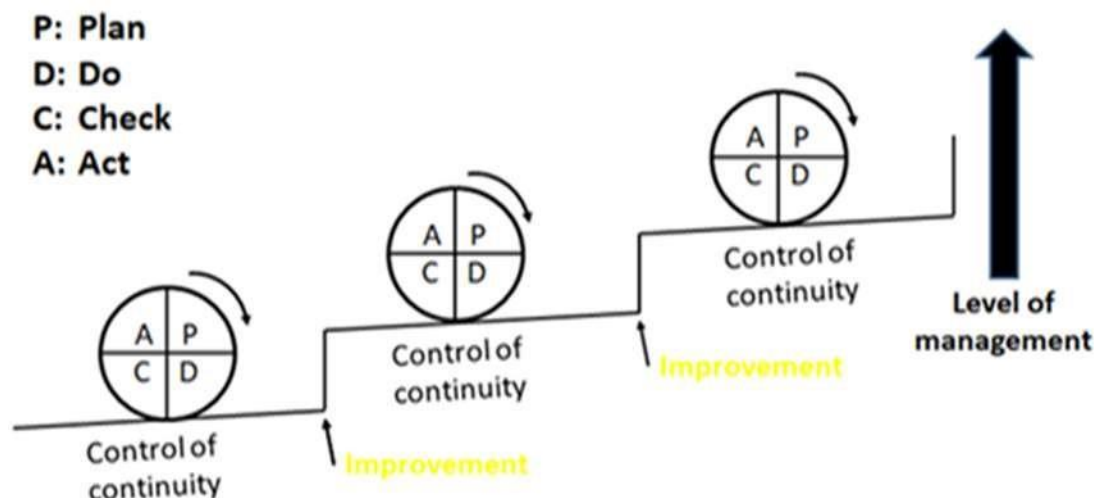


Figure 2: The PDCA Cycle Model

The Four Phases of the PDCA Cycle

The PDCA cycle begins with the Planning phase which involves the identification of the problem and objectives. During this phase, a collaborative effort is made to agree on the problem to be solved or the process to be improved. Subsequently, an in-depth analysis of the existing as-is situation is conducted, alternative solutions are identified, and the most promising solution is selected and scheduled for implementation.

In the Do phase, the selected solution is put into action on a limited scale. This phase also involves ongoing progress measurement, data collection, and feedback gathering to facilitate subsequent analyses.

The Check phase involves analyzing the collected data and feedback and comparing the outcome against pre-established objectives. This phase allows to evaluate how well the solution has worked and where further enhancement may be needed. Additionally, it involves the identification of unexpected issues and the gathering of key learning. It is important to note that the Do and Check phases may need to be repeated until the desired results are achieved.

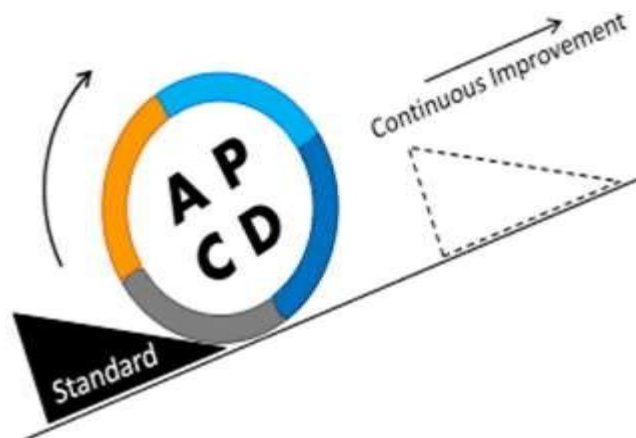


Figure 3: PDCA and Standardization

The Act phase is the point at which the chosen solution is fully integrated. This phase requires taking actions based on the insights acquired from the Check phase. A plan for full-scale implementation is carried out, considering the associated costs and benefits. The Act phase also concerned with standardizing, documenting, sustaining the improved process, as well as integrating it into the organizations system.

The utilization of the PDCA cycle doesn't necessarily stop once the Act phase is completed. The improved process often becomes the new baseline, which may prompt a return to the Plan phase. Multiple iterations of the PDCA cycle may be essential for a permanent resolution of the problem and the attainment of the desired future state. Each cycle brings one closer to their goals and extends their knowledge further.

1.4 Benefits of Implementing Kaizen

Implementing Kaizen, a Japanese philosophy of continuous improvement, offers a range of benefits to organizations. Here's a breakdown of the key advantages:

Increased Productivity and Efficiency

- **Streamlined Processes:** Kaizen encourages the analysis and optimization of processes to eliminate bottlenecks, redundancies, and unnecessary steps.
- **Standardized Work:** By standardizing procedures and best practices, Kaizen ensures consistency and efficiency across operations.
- **Continuous Flow:** Kaizen aims to establish continuous flow production, reducing lead times and increasing throughput.

- **Just-in-Time (JIT) Production:** Kaizen principles align with JIT production, enabling organizations to produce goods only as needed, minimizing inventory holding costs and maximizing resource utilization.
- **Automation and Technology Integration:** Kaizen encourages the adoption of automation and technology to enhance efficiency and reduce manual workloads

Cost Reduction and Waste Elimination

- **Identification of Waste:** Kaizen methodologies, such as value stream mapping and gemba walks, help identify and categorize different types of waste, including overproduction, inventory excess, waiting time, defects, transportation, motion, and underutilized talent.
- **Kaizen Events:** These focused improvement activities bring together cross-functional teams to address specific areas of waste and inefficiency, resulting in targeted cost reductions and process improvements.
- **Cost-Benefit Analysis:** Kaizen promotes a culture of cost-consciousness and continuous improvement, encouraging employees to identify cost-saving opportunities and implement solutions that offer a favorable return on investment.

Improved Quality and Customer Satisfaction

- **Root Cause Analysis:** Kaizen emphasizes the importance of root cause analysis to identify and address the underlying factors contributing to quality defects and customer dissatisfaction.
- **Error Proofing (Poka-Yoke):** Kaizen encourages the implementation of error-proofing techniques to prevent mistakes and defects before they occur, ensuring consistent quality and reliability.
- **Customer Feedback Integration:** Kaizen involves gathering and incorporating customer feedback into improvement efforts, aligning products and services with customer needs and expectations.
- **Continuous Feedback Loops:** Kaizen promotes the establishment of continuous feedback loops to monitor and improve quality performance over time, fostering a culture of continuous learning and adaptation.

Employee Morale and Satisfaction

- **Empowerment and Involvement:** Kaizen empowers employees at all levels to contribute ideas, suggestions, and solutions for improvement, fostering a sense of ownership and pride in their work.
- **Skill Development:** Kaizen provides opportunities for skill development and cross functional collaboration through participation in improvement teams, training programs, and knowledge sharing initiatives. Quality circles are small groups of employees who voluntarily come together to identify, analyze, and solve work-related problems within their area of expertise. These circles promote teamwork, collaboration, and shared responsibility for quality and improvement. They provide a forum for employees to exchange ideas, share best practices, and contribute to organizational goals.

- Continuous improvement is not a one-time initiative but rather a continuous journey towards excellence. By embracing these key concepts and methodologies, organizations can foster a culture of innovation, efficiency, and quality that drives sustainable growth and competitiveness.
- Recognition and Rewards: Kaizen recognizes and rewards employee contributions to improvement efforts, reinforcing a culture of recognition, appreciation, and motivation.
- Job Enrichment: Kaizen encourages job enrichment by assigning employee's meaningful tasks and responsibilities related to improvement projects, enhancing job satisfaction and engagement.

Self-check questions 2	Written test
------------------------	--------------

1. What are the main differences between incremental changes and radical improvements in the context of continuous improvement?
2. Describe the four phases of the PDCA Cycle briefly.
3. What are quality circles, and how do they support teamwork and improvement initiatives?
4. Name two benefits of implementing Kaizen related to increased productivity and efficiency.

Unit Summary

Kaizen is a Japanese philosophy that emphasizes continuous improvement, focusing on small, incremental changes to achieve greater efficiency, quality, and effectiveness. The term "Kaizen" translates to "change for the better" and is not just about small changes, but also about everyone involved in making improvements. Kaizen has its roots in post-World War II Japan, where it was adopted by industries such as Toyota, which became synonymous with the Kaizen philosophy. The Kaizen philosophy is built on several key principles. Continuous improvement is at the heart of Kaizen, emphasizing the need for ongoing improvement in all aspects of operations. Respect for people is also a key principle, promoting a culture of mutual respect, trust, and empowerment where employees are actively engaged and encouraged to voice their ideas. Elimination of waste is another important principle, as is standardization, which ensures consistency, reliability, and repeatability in processes and operations. Quality at the source is also a key principle, which means identifying and addressing quality issues at their origin.

Employee involvement and empowerment are critical components of continuous improvement. Employees are encouraged to take ownership of their work and identify areas for improvement, which helps to foster a sense of responsibility and accountability.

The PDCA cycle is a four-step model for systematic problem-solving and continuous improvement. The cycle consists of Planning, Doing, Checking, and Acting. It is used to enhance the quality of processes, products, and services by following a logical sequence of four steps. Quality circles are small groups of

employees who voluntarily come together to identify, analyze, and solve work-related problems within their area of expertise. These circles promote teamwork, employee engagement, and continuous improvement.

Overall, Kaizen is a powerful philosophy that can help organizations improve their efficiency, quality, and effectiveness by promoting continuous improvement and employee involvement. By embracing the principles of Kaizen and using tools such as the Kaizen board and PDCA cycle, organizations can create a culture of continuous improvement that benefits both employees and customers.

Unit Review Questions

Part I: Choose the best answer

1. Which one of the following is true about kaizen?

- | | |
|------------------------|---------------------------|
| A. Change for better | C. Continuous improvement |
| B. Reduce productivity | D. A& C |

2. The origin of kaizen is _____

- | | |
|------------|-------------|
| A. England | C. Japan |
| B. Korea | D. Ethiopia |

3. Which one of the following is the benefit of kaizen?

- | | |
|-------------------------------------|-----------------------------------|
| A. To make work place more pleasant | C. To develop members' capability |
| B. To improve customer satisfaction | D. All |

4. Kaizen refers to _____

- | | |
|-----------------------------|------------------------------|
| A. Continuous improvement | C. Discontinuous improvement |
| B. Intermittent improvement | D. Radical improvement |

5. In the process of Kaizen, improvements are accomplished gradually in small increments.

- A. True B. False

6. Who is encouraged to participate in the practice of Kaizen within organizations?

- A. Only top management
- B. Only frontline workers
- C. Only middle management

- D. All employees from top management to frontline workers
- 7. What is the purpose of the PDCA cycle in continuous improvement?
 - A. To identify problems but not implement solutions
 - B. To execute improvement plans without measuring results
 - C. To provide a framework for iterative improvement
 - D. To involve employees in decision-making without empowerment

Answer keys for self-check questions

Answers to self-check questions 1

1. Continuous improvement is vital in Kaizen, driving ongoing small enhancements to adapt, increase efficiency, and maintain competitiveness.
2. Three key Kaizen principles are: Respect for People, advocating for employee engagement; Elimination of Waste, promoting efficiency; and Quality at the Source, ensuring accountability for quality.
3. Kaizen empowers employees by involving them in problem-solving and improvement initiatives, fostering a culture of collaboration and innovation.

Answer to self-check questions 2

1. Incremental changes involve small, gradual adjustments, while radical improvements are significant and transformative changes.
2. The four phases of the PDCA Cycle are Plan, Do, Check, and Act.
3. Quality circles are small groups of employees who collaborate to solve work-related problems.
4. Kaizen benefits include streamlined processes and standardized work procedures, leading to increased productivity and efficiency.

UNIT 2

Waste Identification and Elimination

Learning outcome:

At the end of this unit, students will be able to:

- Understand the concept waste
- Identify various types of waste
- Develop strategies to eliminate waste

Activity

Dear students, discuss the following Waste questions with your peers

- a) How can you define waste in your own context?
- b) Can you list down example of wastes in livestock farms?
- c) Can you identify any instances of time waste in your routine activities?
- d) Discuss the importance of adopting a continuous improvement mindset in waste reduction efforts. How does this mindset contribute to organizational success?

2.1 Introduction to Waste

In Japanese, "muda" translates to "waste." In the context of Kaizen, muda refers to any activity or process that does not add value to the final product or service from the customer's perspective. Identifying and eliminating muda is crucial for improving efficiency, reducing costs, and enhancing overall quality.

Within a kaizen culture, **waste** is anything that doesn't add value from the customer's perspective. It includes activities that consume resources, increase the cost of products or services but contribute zero value to the customer, and therefore should be eliminated. **Waste Analysis** is one of the core principles of kaizens' thinking that involves the identification, quantification, elimination, and prevention of waste. It is also one of the easiest ways an organization can improve its operations.

Waste takes many forms and can be found at any time and in any place. Additionally, the application of waste analysis is universally relevant across manufacturing, service, and office environments. Many classifications of waste exist, with the **Eight Wastes** model being a widely adopted framework across multiple industries. Categorizing waste into these eight forms makes them easier to identify and helps identify priorities for action. In the next sections, we'll elaborate more the eight types of waste.

Key terms: Waste/Muda

What is Muda/waste?

Waste is any action or step in a process that does not add value to the customer. In other words, waste is any process that the customer does not want to pay for. The original seven wastes (Muda) were developed by Taiichi Ohno, with the Eight Wastes model being a widely used framework today.

There are two types of wastes: obvious wastes and hidden wastes. It is important to uncover and eliminate the latter since they are usually bigger. Wastes take the shape of an iceberg; the tip consists of the obvious wastes while the seen bulks under the water contain the hidden wastes. Wastes are not necessarily ugly, and most are outside the waste can! Waste can be in the form of unnecessary output, input, or processing. It can be in the form of materials, stocks, equipment, facilities, man-hours, utilities, documents, expenses, motion, and other activities that do not add value.

Self-check questions 3

1. Define waste according to the context of Kaizen philosophy.
2. Explain the difference between obvious wastes and hidden wastes.
3. Provide examples of different forms of waste in livestock operations.

2.2 Types of Waste

Waste is one of the biggest enemies of manufacturing efficiency and profitability. It can increase your costs, lower your quality, and reduce your customer satisfaction. But how do you identify and eliminate waste in your manufacturing processes? One of the most widely used methods is based on the concept of Muda.

Muda is a Japanese word that means waste or futility, and it refers to any activity that does not add value to the product or service. According to the lean philosophy, there are seven types of Muda that you need to eliminate or minimize in manufacturing/Service processes. In this unit, we will explain what these types are and how you can measure and reduce them using some practical examples.

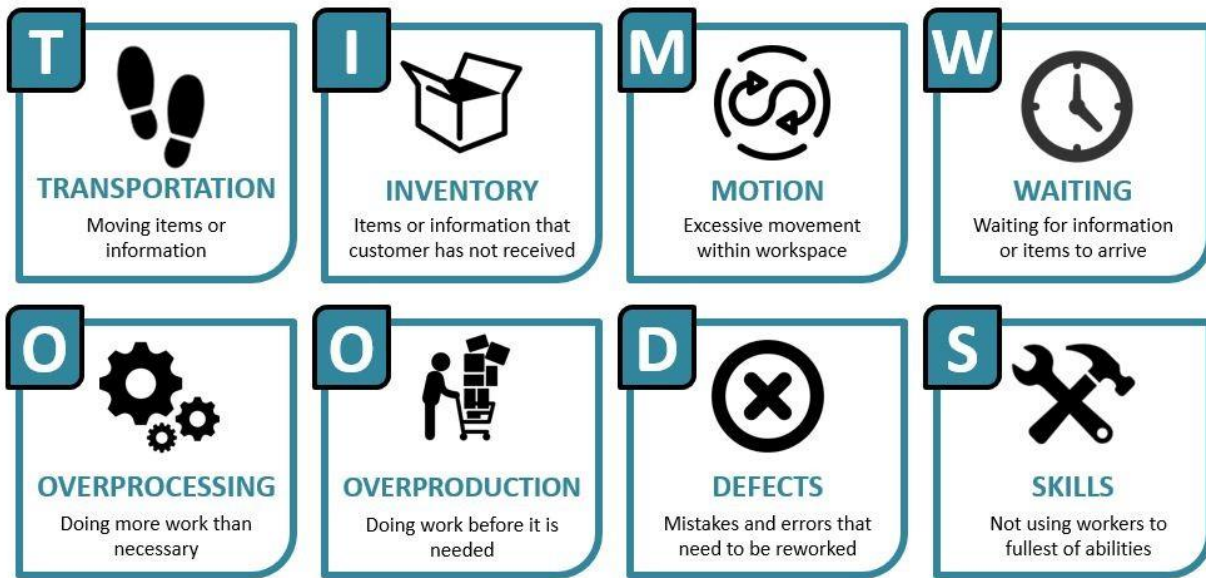


Figure 5: The 8 wastes/Muda

Identifying waste is an ongoing process that should be a part of your farm operation's continuous improvement plan. The eight forms of waste discussed here do not appear in isolation, and if one form is identified, it is usually accompanied by another. Being a lean farming operation will help maximize production and output no matter the size agribusiness you operate. The following are types of waste in agricultural production: -

1. Overproduction:

A farmer who hasn't secured enough market shares or hasn't properly estimated consumer expectations may be experiencing a type of waste called overproduction. Producing more than is needed or producing faster than the next stage of value-added processing can lead to overproduction. Overproduction can lead to a farmer incurring additional costs to their operations such as storage fees, reduced prices due to oversupply, and food waste. Strategies that can be implemented in a farmer's operation to reduce overproduction are consumer demand forecasting, adjusting planting and breeding cycles based on market trends, and finding ways to create additional products from the excess that is produced.

Example of overproduction includes factory farms/commercial farms cram animals into small spaces and in the plainest terms they overproduce the number of animals they have in one place. It's no different than a machine producing so many parts that you can hardly walk around the machine. The overproduction of animals results in inventory that is hard to manage. The defects come in the form of sick animals.



Figure 6: Overproduction in dairy farms.

2. Excess inventory:

Too much of a good thing can lead to waste in your farm operation. Excess inventory may seem like you're preparing for a rainy day, but you're actually incurring costs, such as storage and depreciation of equipment and materials. Inventory comes in many forms: raw materials (seeds, fertilizers, breeder livestock), finished goods, and work-in-progress. Goods waiting to be transformed or converted to another form are considered work-in-progress. This is a common form of inventory buildup in farm operations that can be reduced through implementation of just-in-time inventory management practices and forecasting of required materials.



Figure 7: Basic types of inventories

3. Transportation Waste

Excess movement of materials, livestock, and produce on the livestock farm can quickly cause farming operation to incur costs. Transportation waste can appear in many ways on livestock farms, such as irrigation, field layouts, or even how your livestock are transported to new pasture. Strategies to reduce transportation waste include optimizing field layouts to minimize the distance used by your tractors and travel in your irrigation systems, and implementing precision agriculture technology that can assist equipment in choosing pre-plan routes that optimize distances traveled.

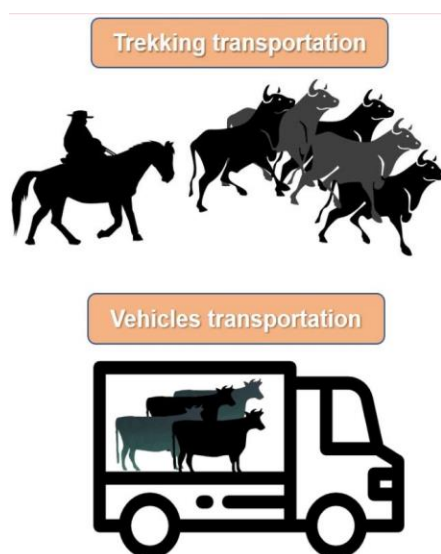


Figure 8: Transportation waste

4. Motion Waste

Motion is a form of waste caused by the humans involved in farm operations performing unnecessary movements while completing tasks. This form of waste is commonly overlooked due to it being written off as a part of the process. Examples include, manual collection of eggs from nests or floor instead of using automated egg collection system, farmers walking long distances to fetch tools, equipment requiring manual adjustments instead of automation, and inefficient layout of farm buildings leading to extra steps. Similar to reducing transportation waste, optimizing farm layout for efficient workflow, investing in automated equipment where feasible, and implementing ergonomic principles can reduce unnecessary movement.



Figure 9: Muda of Motion (manual vs automated egg collection)

5. Waiting-Time Waste

Waiting is a form of waste that is nearly impossible for a farmer to avoid. Planting, harvesting, breeding, raising livestock all require a period of waiting, but there are forms of waiting that can be minimized in farming operations, such as equipment repair, delayed harvest times due to unavailable labor, and delays of shipments of agricultural inputs. The main antidotes to reducing wait times are proper planning and scheduling of activities. The planning process should include building partnerships with consistent suppliers, investment in reliable equipment, and continuous improvement to workflow processes.



Figure 10: Waiting time waste

6. Over Processing Waste

As farmers, we want the end user to have the best products or services. Unfortunately, this leads us at times to bring products and services to end users with extras they may not necessarily require or value. This form of waste is known as extra-processing. Excessively washing or polishing produce beyond what is necessary

for cleanliness or appearance, over-packaging fruits or vegetables in multiple layers of plastic or cardboard, and thoroughly grading and sorting produce into narrow size or quality categories when a broader range would be acceptable are forms of extra processes that can lead to increase labor costs, wasted resources, damage to products, and higher prices for end users. Extra-processing can be minimized by understanding customer needs and wants by performing market surveys, finding ways to efficiently package goods, and training employees to identify forms of extra processing steps.



Figure 12: over processing of livestock products

Identifying waste is an ongoing process that should be a part of your farm operation's continuous improvement plan. The eight forms of waste discussed here do not appear in isolation, and if one form is identified, it is usually accompanied by another. Being a lean farming operation will help maximize production and output no matter the size agribusiness you operate.

7. Defects Waste

When looking to identify defects in your processes, find products or services that you produce that do not meet the intended requirement or reasonable expectation of use by the end user. Once a defective product or service is found, a best practice to reduce the number of defective items produced is to examine each activity in the workflow to ensure that people, machines, and other materials used in the creation of product or service are optimized and used correctly. On-farm examples of defects include cracked eggs, diseased fruits, blemished vegetables, off-grade milk, or low-quality wool. Great ways to reduce defects can include investment in employee training, implementation of sustainable pest management techniques, and soil testing to optimize growing conditions.



Figure 12: Defect

8. Unused Human Skills/wasted talents

Maximizing the potential of your current employees can improve your farm output. Non-utilized talent is a form of waste found in operations that results when employee skills and talents aren't appropriately applied to the processes they manage. Allowing input from employees when designing the workflow of processes on how they are implemented will allow them to have their individual talents shine through in your farm's operations.

Self-check questions 4

1. What is Muda, and why is it crucial in the agricultural sector?
2. Provide examples of overproduction waste in livestock industry.
3. How does excess inventory affect livestock industry?
4. Define transportation waste in the context of the livestock industry.

2.3 Understanding Waste in the Workplace

Value-added vs. non-value-added activities:

- Value-added activities: These are activities that directly contribute to meeting customer needs and requirements. They enhance the quality, functionality, or feature of the final product or service and are perceived as valuable by the customer.
- Non-value-added activities: Non-value-added activities are those that do not contribute to meeting customer needs and requirements. They include tasks, processes, or steps that add no value to the

final product or service and are considered wasteful. Identifying and eliminating non-value-added activities is essential for improving efficiency and reducing costs in the workplace.

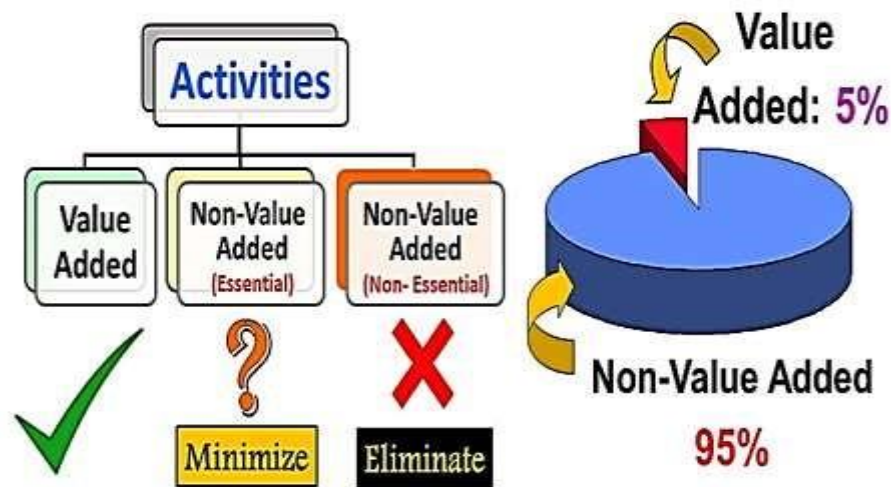


Figure 13: value adding vs non-value adding activities

Sources and Effects of Waste in Production Processes:

Sources of waste:

Waste in production processes can arise from various sources, including overproduction, waiting times, transportation inefficiencies, unnecessary motion, over processing, excess inventory, and defects or errors in products or services. Eliminating these sources of Muda is the primary goal of lean manufacturing to improve efficiency, quality and productivity.

The 5M+S framework is a useful tool for identifying sources of Muda (waste) in production processes.

The 5M stands for:

- Man (People) - Untrained workers performing unnecessary motions, lack of skills, poor ergonomics
- Machine - Outdated equipment causing frequent breakdowns and defects
- Material - Excess inventory of obsolete parts, poor quality materials
- Method - Unclear work instructions leading to over processing, inefficient processes
- Measurement - Lack of process control data to detect defects early/The +S represents:
- Surroundings - Poor layout, lighting, noise, temperature causing worker fatigue and errors

Effects of waste: Waste negatively impacts productivity, efficiency, and profitability in the workplace. The effects of Muda, or waste, in production processes can be detrimental to organizations in various ways:

- **Increased Costs:** Waste leads to unnecessary consumption of resources such as materials, labor, energy, and time. This results in higher production costs, reducing profitability and competitiveness.
- **Reduced Productivity:** Waste creates inefficiencies in production workflows, leading to delays, bottlenecks, and idle time. This reduces the overall productivity of the organization and limits its capacity to meet customer demand.
- **Poor Quality:** Muda often leads to defects, errors, and rework in the production process. These results in lower product quality, increased customer complaints, and higher costs associated with warranty claims and returns.
- **Excess Inventory:** Overproduction and inefficient inventory management practices result in excess inventory levels. This ties up capital, occupies valuable storage space, and increases the risk of obsolescence or spoilage.
- **Long Lead Times:** Waste such as waiting, transportation delays, and inefficient processes contribute to longer lead times for delivering products to customers. This reduces responsiveness to customer needs and increases the risk of losing business to competitors.
- **Employee Frustration:** Waste in the form of inefficient processes, poor communication, and underutilization of talent can lead to frustration and disengagement among employees. This affects morale, job satisfaction, and retention rates.
- **Environmental Impact:** Some forms of waste, such as excessive energy consumption, pollution, and waste generation, have negative environmental consequences. This can harm the organization's reputation, lead to regulatory compliance issues, and incur additional costs for environmental remediation.
- **Loss of Competitive Advantage:** Organizations that fail to address waste effectively risk losing their competitive advantage in the market. Competitors who can produce higher quality products more efficiently are likely to capture market share and outperform them.

Visual Management Tools for Waste Identification:

Visual management is a business management approach that communicates important information in a visual and real-time manner. It is a system of labels, signs, markings, information displays, and visual guides instead of written instructions. Kaizen organizations rely significantly on visual management to detect abnormalities, reinforce standards, and ensure stability and safety is maintained in the workplace. Visual management is particularly important during the early phase of Lean implementation.

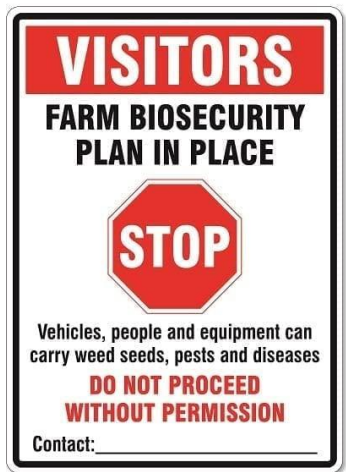


Figure 14: Visual signs and Visual Board

A good illustration that demonstrates the power of visual management is found in road signs, traffic lights, and lane markers on the road. The messages they convey are so clear that when you see a traffic light for example, you know exactly what you should be doing. Research has consistently demonstrated that people tend to learn and process information more effectively when presented visually. Our brains inherently respond with greater speed and accuracy to colors, shapes, patterns, graphics, and pictures. Just as road signs are easier to understand than written signs, workplace visuals are easier to understand than written instructions. Therefore, incorporating effective workplace visuals can yield positive impacts on safety, productivity, quality, and on-time delivery.

Visual management includes a wide range of visual controls that help making all workplace elements and processes more visually apparent. These visual controls can be:

- Informative to show identity, directions, strategic goals, customer expectations and compliance requirements.
- Instructional to communicate SOPs, work-related information, and workplace organization and maintenance activities.
- Result-oriented to display the status of processes, projects, production, productivity and performance.

Many techniques and principles rely on visual management

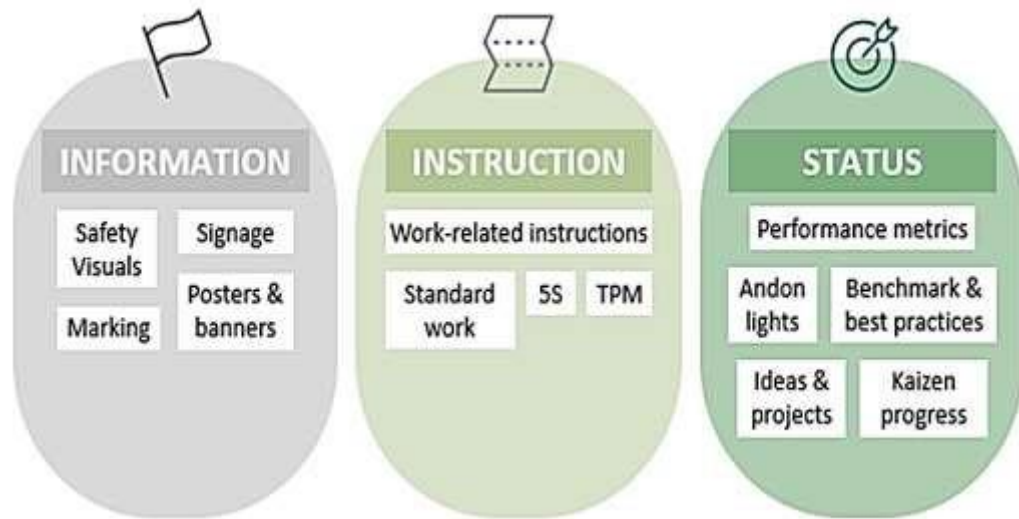


Figure 15: Visual Management techniques

Kaizen board

Kaizen board is a bulletin board set up at a workplace or in a publicly accessible place in the factory or the company in order to disseminate information about the Kaizen activities at the workplace and the company. Information put up on the board includes various Kaizen- related news and announcements, either company-wide one or particular workplace related.

It is a means of management -employee communication. Information sharing in this manner helps foster employees' sense of participation, recognition and motivation in Kaizen activities. Every working team has to prepare and use a Kaizen board. This encourages for the teams to work “as independent as possible” and transforms their ideas to improvements. As long as every team uses a Kaizen board, it becomes also easy for the management to be informed at any time, just by walking around and checking the information on the board. In general, a Kaizen board is important for:

- Continuous Kaizen activity in a company or organization.
- Participation of all employees during Kaizen activity through Suggestion system.
- Employees including management to know about Kaizen performance in their work area or organization.
- Employees and management to know about production plans and performance.

The size of a Kaizen board should be 2 times a flip chart paper. It has four corners or parts depending on the information displayed.

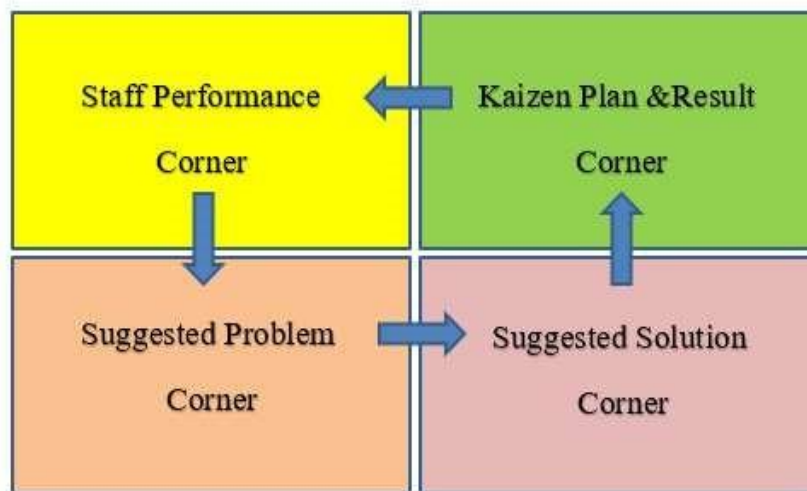


Figure 16: Kaizen Board

The “**staff performance corner**” shows the actual performance of the staff and the gaps and training needs. The staff performance can be shown on the Kaizen board using different colors such as red for low performer, blue for average performer, and green for best performer.

The “**Kaizen plans & results corner**” shows the results generated from implementing Kaizen activities. Improvement graphs can be displayed and should be updated regularly at least on weekly basis. If the results are below the planned target, the team has to discuss and find the root cause and implement solution

The “**suggested problems corner**” is the place where every team member’s ideas or identified problems are posted. The posted problems have to be discussed and solved by the teams and the solutions should be displayed on the next corner i.e. “suggested solutions corner”.

The “**suggested solutions corner**” displays the solutions suggested for known problems. And the solution ideas have to be implemented and the results achieved have to be shown on the “Kaizen results corner”.

2.4 Identifying and Eliminating Muda

Gemba Walks and Observation Techniques:

Gemba walks involve going to the actual workplace, observing operations, and engaging with employees to understand work processes, identify inefficiencies, and uncover sources of waste. By being on the "gemba" (the actual place where work is done), managers and leaders gain valuable insights into waste and opportunities for improvement.

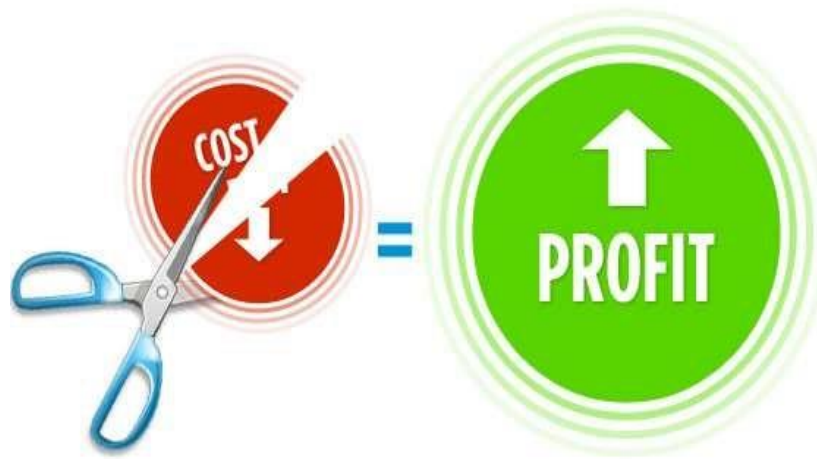


Figure 17: Gemba Walks and Observation Techniques

Gemba walks are a powerful tool for understanding and improving processes by directly observing the actual work being done. Here are some key techniques for conducting effective Gemba walks and observations:

Prepare for the Walk

- Define a clear purpose and scope for the walk
- Prepare questions, checklists, and tools to guide the observation
- Inform the team ahead of time to put them at ease

Observe and Engage

- Start at the end of the process and work backwards
- Observe the process as a whole, not just individual steps
- Look for value-added vs non-value-added activities, wastes, and inefficiencies
- Trace the flow of materials, information, and people

- Compare the actual process to the standard process
- Interview employees with open-ended questions to gain their perspective
- Avoid disrupting the process or providing solutions on the spot

Document Findings

- Record observations, ideas, and findings
- Take photos or videos to document the process
- Avoid preconceived notions and keep an open mind

Follow Up

- Discuss learning with the team and determine improvement opportunities
- Implement changes and return to the Gemba to verify results
- Regularly conduct Gemba walks as part of continuous improvement

The key is to go to the actual place of work, observe the process, engage employees, and identify opportunities to streamline operations and eliminate waste. Proper preparation, an open mindset, and follow-through are essential for Gemba walks to be effective.

Root Cause Analysis for Waste:

Root Cause Analysis (RCA) is a systematic method used to identify and address the underlying causes of problems or waste in a process. The goal of RCA is to eliminate the root cause of the problem, rather than just treating its symptoms. Here's a step-by-step guide to conducting a Root Cause Analysis for waste identification and elimination:



Figure 2: root cause vs symptom

Step 1: Define the Problem

- Identify the specific problem or waste that needs to be addressed.
- Clearly define the problem statement, including the scope, impact, and any relevant metrics.

Step 2: Gather Data

- Collect relevant data and information related to the problem.
- Review documents, records, and reports to understand the process and identify potential causes.
- Conduct interviews with stakeholders, including employees, customers, and suppliers.

Step 3: Identify Potential Causes

- Brainstorm potential causes of the problem using tools such as:
 - Fishbone diagrams (Ishikawa diagrams)
 - Cause-and-effect diagrams
 - Pareto charts
 - Flowcharts
- Identify potential causes based on the data and information gathered.

Step 4: Analyze Causes

- Evaluate each potential cause using tools such as:
 - Failure Mode and Effects Analysis (FMEA)
 - Fault Tree Analysis (FTA)
 - Systemic Failure Analysis
- Identify the most likely cause of the problem.

Step 5: Identify Root Causes

- Use the analysis results to identify the root cause of the problem.
- A root cause is defined as the underlying cause that has led to the problem, rather than a symptom or immediate cause.
- Ensure that the root cause is specific, measurable, achievable, relevant, and time-bound (SMART).

Step 6: Develop Action Plan

- Based on the identified root cause, develop an action plan to address it.
- Identify specific steps to eliminate or mitigate the root cause.
- Assign responsibilities and establish timelines for implementation.

Step 7: Implement and Monitor

- Implement the action plan and monitor its effectiveness.
- Track progress and adjust the plan as needed.
- Continuously evaluate and improve the process.

2.5 Continuous Improvement Mindset in Waste Reduction

Adopting a continuous improvement mindset is essential for sustaining waste reduction efforts over time. The concept of a continuous improvement mindset in waste reduction emphasizes the ongoing effort to identify, address, and eliminate waste within an organization. It involves fostering a culture of innovation, learning, and proactive problem-solving where employees at all levels are engaged in seeking opportunities for improvement. Here's how this mindset contributes to waste reduction:

Proactive Identification of Waste: Employees are encouraged to continuously observe and analyze processes to identify sources of waste. By being proactive in waste identification, organizations can address inefficiencies before they escalate and negatively impact productivity and quality.

Empowerment and Involvement: Cultivating a continuous improvement mindset empowers employees to take ownership of waste reduction initiatives. When employees feel empowered and involved in the decision-making process, they are more likely to actively participate in waste reduction efforts and contribute innovative solutions.

Iterative Problem-Solving: Embracing a continuous improvement mindset involves adopting an iterative approach to problem-solving. Instead of viewing waste reduction as a one-time effort, organizations continuously seek opportunities for improvement, implement solutions, evaluate outcomes, and make further refinements.

Learning Culture: Organizations with a continuous improvement mindset prioritize learning and knowledge sharing. They encourage employees to experiment with new ideas, learn from both successes and failures,

and share best practices across teams and departments. This culture of learning fosters creativity, innovation, and continuous improvement.

Data-Driven Decision-Making: A continuous improvement mindset emphasizes the importance of data-driven decision-making in waste reduction efforts. By collecting and analyzing data related to process performance, organizations can identify trends, root causes of waste, and opportunities for improvement, enabling more informed decision-making.

Leadership Support and Alignment: Leadership plays a crucial role in fostering a continuous improvement mindset. Leaders should actively support and promote waste reduction initiatives, allocate resources, and provide guidance to ensure alignment with organizational goals and objectives.

Sustained Focus on Improvement: Finally, a continuous improvement mindset ensures that waste reduction efforts remain a priority over time. Organizations regularly revisit and review their waste reduction strategies, adapt to changing circumstances, and continuously strive for excellence in all aspects of operations.

Unit Summary

The concept of "Muda" or waste is a fundamental principle in the philosophy of Kaizen, a continuous improvement approach.

Muda refers to any activity or process that does not add value to the final product or service from the customer's perspective. This can include unnecessary steps, redundant processes, and inefficient use of resources. Identifying and eliminating waste is crucial for improving efficiency, reducing costs, and enhancing overall quality.

There are eight types of waste that can be identified in the workplace, including overproduction, excess inventory, transportation waste, motion waste, waiting-time waste, over processing, defects, and unused human skills. Overproduction occurs when more products or services are produced than what is needed by the customer, while excess inventory refers to having more materials or information than what is needed. Transportation waste involves moving materials or products unnecessarily, while motion waste refers to unnecessary movement performed by individuals. Waiting-time waste occurs when employees are idle due to delays or inefficiencies, while over processing involves doing more processing than what is valued by the customer. Defects waste refers to errors or defects in products or services, while unused human skills refer to failing to utilize the skills and creativity of employees.

By identifying and eliminating these types of waste, organizations can achieve significant improvements in efficiency and productivity. For example, eliminating overproduction can reduce inventory costs and improve cash flow, while reducing motion waste can improve employee safety and reduce ergonomic hazards. By adopting a culture of continuous improvement and eliminating waste, organizations can achieve sustainable growth and competitiveness, and deliver high-quality products and services to their customers.

Unit Review Questions

Part I: Answer the following questions

1. Unnecessary Motion is any movement of people that does not add _____ to the product.
A. Cycle Time C. Defects
B. Value D. Muda
2. Reaching or straining to reach a tool is an example of what type of waste?
A. Motion C. Transportation
B. Processing D. Inventory
3. The primary difference between the wastes of motion and transportation is that with transportation we are moving goods or inventory and with motion people are moving without goods or inventory.
A. True B. False
4. Defects are caused by -----
A. Inadequate training C. Operator error
B. Skill shortage D. all
5. Waste of correction includes additional work performed on product or service
A. True B. False
6. Which one is over processing waste?
A. Idle equipment C. Excessive movement of worker
B. Excessively washing or polishing produce D. Poor lay out

Part II: Matching

A	B
1. Producing ahead of what's actually needed	A. Motion
2. More materials or information than is	B. Inventory required
3. Unnecessary movement of people and (Materials, equipment, people)	C. Defect
4. Idle time waits	D. Over Production equipment
5. Unnecessary steps in the production process	E. Transportation
6. Rework and scrap due to poor quality	F. Waiting
7. Moving things; shipping, conveyors	G. Processing

Project Work

Look around your school, among the seven types of waste which types of wastes are noticeable in your school compound.

Unit 2 Self –check questions

1. What do you think the causes of waste?
2. What do you suggest to control these wastes?

Answer to self-check questions 3

1. Waste, in the context of Kaizen, refers to any activity or process that does not add value to the final product or service from the customer's perspective.
2. Obvious wastes are easily identifiable, while hidden wastes are more challenging to uncover but often have a larger impact.
3. Examples of waste include unnecessary output, input, or processing, such as excess materials, stocks, equipment, facilities, manhours, utilities, documents, expenses, motion, and other activities that do not add value.

Answer to self-check questions 4

1. Muda" means waste in Japanese, Being a lean farming operation will help maximize production and output no matter the size agribusiness you operate.
2. Cram animals into small spaces and in the plainest terms they overproduce the number of animals they have in one place.
3. Excess inventory means having more materials than necessary, incurring costs, such as storage and depreciation of equipment and materials.
4. Excess movement of materials, livestock, and produce on the farm

UNIT 3

5S Procedure

Learning outcome:

At the end of this unit, students will be able to:

- Understand basic concepts of 5s procedures
- Perform 5S activities
- Promote and maintain 5s culture

Key terms:

- 5s
- Red gate

3.1 Meaning of 5S

The 5S methodology is an improvement tool for organizing and maintaining a disciplined and productive workplace. It facilitates the creation of a better working environment by reducing waste while improving efficiency, safety and quality. 5S represents five fundamental practices that start with the letter “S”. It is commonly applied by manufacturing facilities in production lines, storage areas, maintenance areas, and offices. It is now being increasingly applied across diverse industries including health care, logistics, hospitality and construction.

Rooted in Japanese management principles, 5S was originally developed by Toyota as an integral component of their Lean production system. It is considered an important component of Lean Thinking and a prerequisite for driving other Lean techniques such as TPM and flow optimization. Many companies start their Lean transformation journey with 5S because it is one of the easiest Lean techniques and exposes some of the most visible examples of waste. Many experts believe that you need to be successful with 5S so you don’t struggle with the other techniques during Lean implementation.

Details of 5S approach

5S: Sort- Set- Shine- Standardize- Sustain

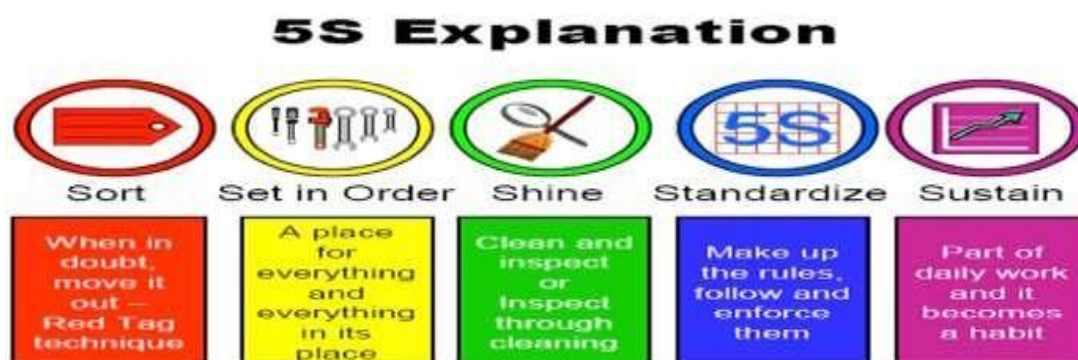


Figure 3: 5S

The 5Ss are: listed by Japanese, English and Amharic language

Japanese	English	Amharic	
Seiri	Sort	ማጣራት	The first step in 5S is to eliminate all the things in the workspace that are not being used and store them away. If a tool or material is not used on a daily basis, eliminate it from the workstation.
Seiton	Set in Order	ማስቀመጥ	The second step is to arrange the items used on a daily basis so that they can be easily accessed and quickly stored. Your goal is to make eliminate any unnecessary movements and actions by the worker to make his process as efficient as possible.
Seiso	Shine	ማፅዳት	Next is to get everything cleaned and functioning properly. The goal is to remove all the dirt and the grime and to keep it that way on daily basis. You want to get it clean and keep it clean.
Seiketsu	Standardize	ማላመድ	The fourth step is to develop a routine for sorting, setting and shining. Standardize creates a system of tasks and procedures that will ensure that the principles of 5S are performed on a daily basis
Shitsuke	Sustain	ማስቀጠል	In the last step, you want to create a culture that will follow the steps on a daily basis. The chief objective of sustain is to give your staff the commitment and motivation to follow each step, day in and day out.

3.2 Benefit of Implementing 5S

- Improves safety and ergonomics
- Reduces searching
- Reduces unplanned downtime
- Enhances teamwork
- Tackles waste
- Improves productivity
- Eliminates distractions
- Reduces inventory and space
- Instills the discipline to follow standard work
- Encourages visual control
- Exposes problems
- Enhances self-management
- Improve quality
- Promotes flow

3.3 Relationship between 5S and Kaizen philosophy

The relationship between 5S and Kaizen philosophy is fundamental in driving continuous improvement and organizational excellence. 5S and Kaizen are closely intertwined concepts that complement each other in the pursuit of efficiency, quality, and waste reduction within an organization.

Relationship between 5S and Kaizen:

- a) **Foundation for Continuous Improvement:** 5S, a methodology focused on workplace organization and efficiency, lays the groundwork for improvement by creating a clean, organized, and safe work environment. Kaizen, on the other hand, is a philosophy of continuous improvement that emphasizes making small, incremental changes over time. Together, 5S provides the foundation for Kaizen to thrive by establishing an ideal workplace environment conducive to continuous improvement
- b) **Sustaining Improvement Gains:** 5S helps sustain the gains achieved through continuous improvement efforts by ensuring that the workplace remains organized, efficient, and conducive to ongoing enhancements. As employees engage in Kaizen activities to improve processes and products, the principles of 5S ensure that the workplace organization is maintained even as changes are implemented, thus supporting the sustainability of improvements over time.
- c) **Cultural Impact:** Both 5S and Kaizen foster a culture of continuous improvement within an organization. While 5S encourages employees to constantly seek ways to enhance workplace organization, Kaizen motivates them to identify opportunities for process and product improvements. Together, these philosophies instill a culture of continuous learning, innovation, and efficiency throughout the organization, driving sustained growth and development

In essence, the relationship between 5S and Kaizen is symbiotic, with 5S providing the groundwork for continuous improvement initiatives driven by the principles of Kaizen. By integrating these methodologies, organizations can create a culture of excellence, efficiency, and innovation that leads to sustained improvements and operational excellence

Self-check questions 5

1. What is the 5S methodology, and how does it improve workplace efficiency?
2. Describe each of the five steps of 5S and their practical applications.
3. What are the key benefits of implementing 5S in an organization?
4. How does 5S relate to the concept of continuous improvement?
5. Explain the symbiotic relationship between 5S and the Kaizen philosophy.

3.4 The 5S Phases

The term 5S is an abbreviation for five Japanese words: **seiri**, **seiton**, **seisou**, **seiketsu**, and **shitsuke**. These five words are often translated into English as: **sorting**, **setting in order**, **shining**, **standardizing**, and **sustaining**.



Figure 4: the 5s phases

Sort/seiri

This phase refers to the practice of going through all the items within the workplace and keeping only what is actually needed. Items which are excess to requirements should either be stored offsite, sold, scraped, or discarded. The main idea behind this phase is to clear the area from distractions to concentrate on what remains in the workplace. This leads to less clutter and wasted time, frees up valuable space, and creates a more streamlined workplace.

Definition of Sort

Sort, the first pillar of 5S, means classifying items in the workplace in to two categories – necessary and unnecessary - and removing all the unnecessary items that are not needed for current operations. It corresponds to the just in time (JIT) principle of “only what is needed, only in the amount needed, and only when it is needed.” The workplace is full of unused machines, jigs, dies, rejects, work-in-process, raw materials, supplies, parts, shelves, containers, desks, workbenches, files, carts, racks, pallets and other

items. People tend to hang onto parts, thinking that they may be needed for the next time. They see an inappropriate machine or equipment and think that they will use it somehow. In this way, inventory and equipment tend to accumulate and get in the way of everyday activities. This leads to a massive build of waste in companywide or in the whole workshop. An easy rule is to remove anything that will not be used within the next 30 days. A ceiling on the number of necessary items should be established. Red-tag holding area can also help to evaluate the need of an item instead of simply getting rid of it. This greatly reduces the risk of disposing of an item that is needed later that will be explained in detail in the next contents.

Benefits of sort activity

Implementing this first pillar creates a work environment in which space, time, money, energy, and other resources can be managed and used most effectively. Sorting can lead to a much safer workplace. By clearing out the items you no longer need, people will have more room to work and things like trip hazards and items falling off shelves will be greatly reduced. Sorting also improves work flow since there is less clutter to deal with and will most definitely increase productivity in both production and office environments. Problems and annoyances in the work flow are reduced, communication between workers is improved, and product quality is increased, and productivity is enhanced. If the first pillar is not well implemented, the following types of problems occur:

1. The factory or a workshop becomes increasingly crowded and hard to work in.
2. Unnecessary lockers, shelves, cabinets and items make communication between employees difficult.
3. Time is wasted in searching for parts and tools.
4. Increase unnecessary maintenance cost of unneeded inventory and machinery.
5. Excess stock-on-hand hides other types of problems in production.
6. Unneeded items and equipment make it harder to improve the process flow

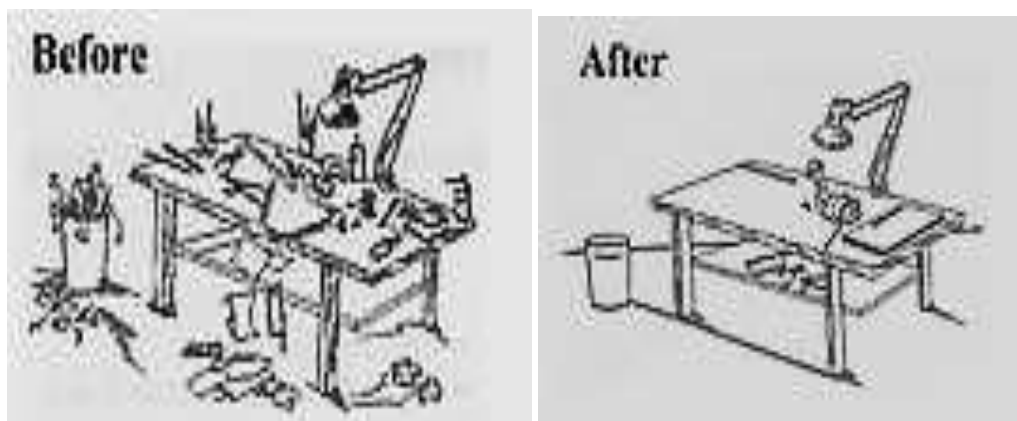


Figure 5: sorting activity

Implementing sort activity:

It is not always easy to identify unneeded items in a factory or workshop. Workers seldom know how to separate items needed for current production from unnecessary items. The following procedures will help in implementing sort activity.

Sorting is a step that involves selecting what you need to complete the job and removing everything else from your work area.

Focuses on eliminating unnecessary items from the workplace

Categorize equipment, furniture, tool in your working place into the following 3 categories

1. Necessary
2. Unnecessary
3. May not necessary\

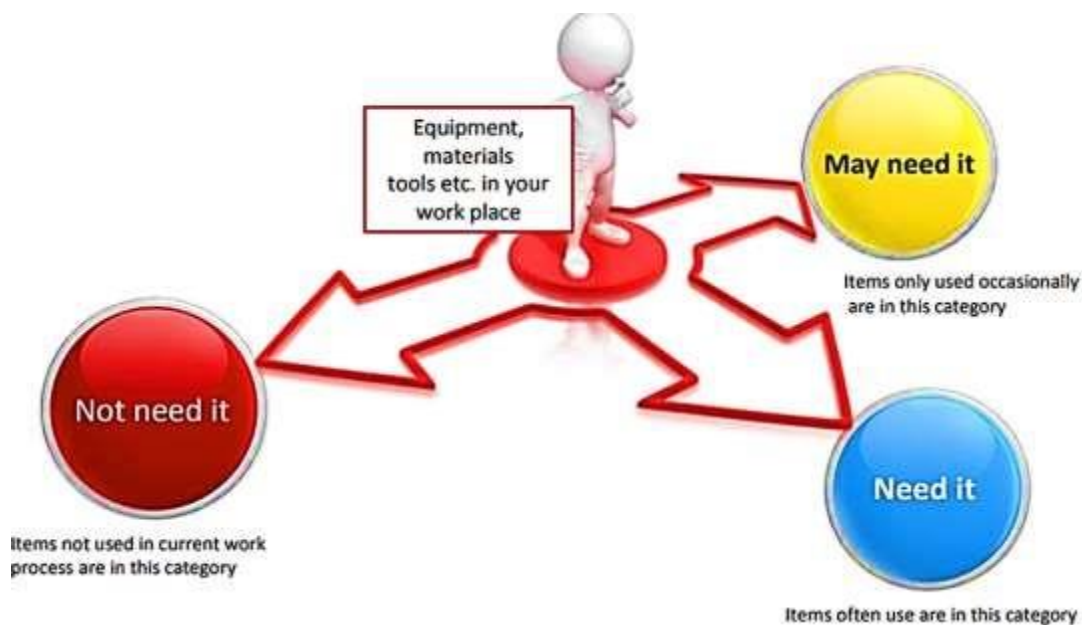


Figure 6: Identifying necessary vs unnecessary items

Overview of red tagging

The Red-Tag Strategy is a simple method for identifying potentially unneeded items in the factory or workshop, evaluating their usefulness and dealing with them appropriately. Red tagging means putting red

tags on items in the factory or workshop that need to be evaluated as being necessary or unnecessary. A Red tag is a red colored tag used to identify items no longer needed in a particular work area.

The red tags catch people's attention because red is a color that stands out. An item with a red tag is asking three questions:

- Is this item needed?
- If it is needed, is it needed in this quantity?
- If it is needed, does it need to be located here?

Once these items are identified, they can be held in a “Red Tag Holding Area” for a period of time to see whether they are needed, disposed of, relocated, or left exactly where they are

RED TAG

Area found: _____

Item name: _____

Quantity: _____ Date: _____

Tagged by: _____

Category:

<input type="checkbox"/> Tool	<input type="checkbox"/> Equipment
<input type="checkbox"/> Raw material	<input type="checkbox"/> Packaging
<input type="checkbox"/> Machine part	<input type="checkbox"/> Instrument
<input type="checkbox"/> Stationary	<input type="checkbox"/> Documentation
<input type="checkbox"/> Furnishing	<input type="checkbox"/> Consumable
<input type="checkbox"/> Other _____	

(MFG.) TAG#: 159392 www.citoolkit.com

RED TAG

Reason for Red Tag:

<input type="checkbox"/> Unusable	<input type="checkbox"/> Occasionally used
<input type="checkbox"/> Defected	<input type="checkbox"/> Obsolete/ Aged
<input type="checkbox"/> Redundant	<input type="checkbox"/> Expired
<input type="checkbox"/> Other _____	

Action to Take:

<input type="checkbox"/> Return back	<input type="checkbox"/> Sell
<input type="checkbox"/> Discard	<input type="checkbox"/> Scrap
<input type="checkbox"/> Relocate _____	
<input type="checkbox"/> Other _____	

Supporting Information:

Figure 7: Red tag (Source: www.citoolkit.com)

Steps/procedures in Red tagging

The red-tagging process in a department or work area can be broken down into seven steps.

- Step 1: Launch the red-tag project.
- Step 2: Identify the red-tag targets.
- Step 3: Set red-tag criteria.
- Step 4: Make red tags.
- Step 5: Attach red tags.

- Step 6: Evaluate red-tagged items.
- Step 7: Document the results of red-tagging.

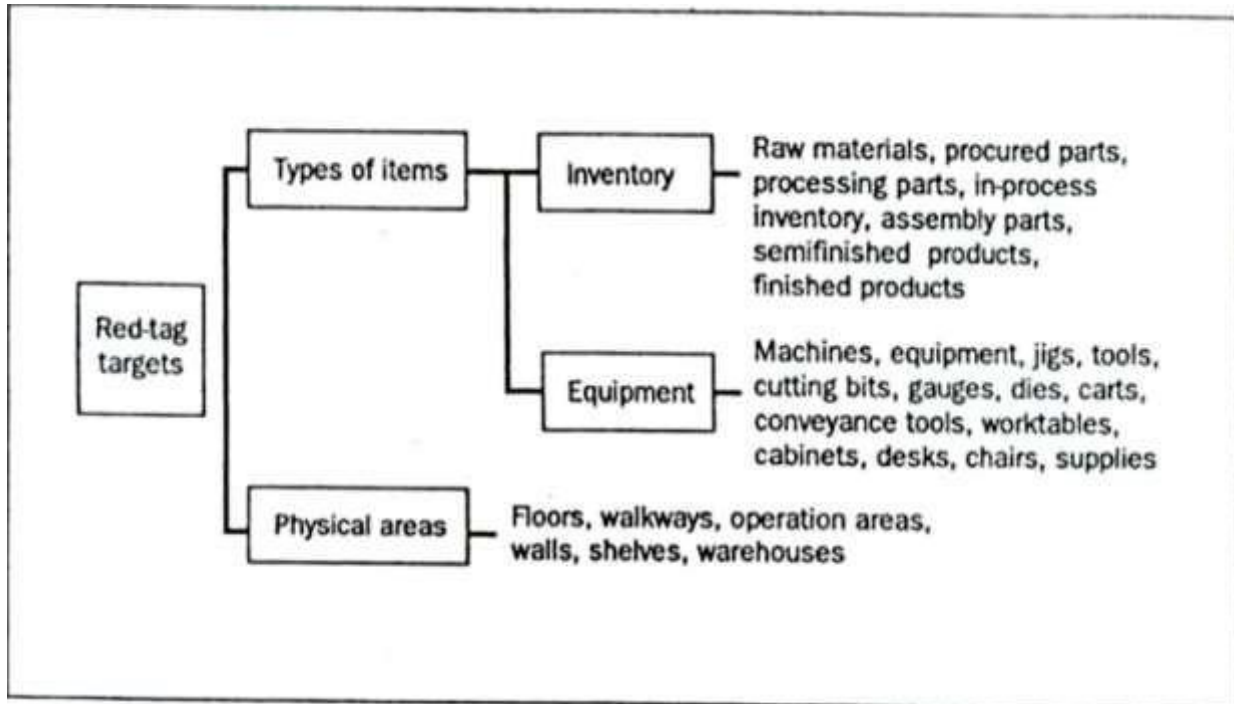


Figure 8: Red tag flow

Identifying Necessary Vs. Unnecessary Items:

This step involves assessing all items within a work area to distinguish between those that are necessary for current operations and those that are unnecessary or redundant. Employees are encouraged to critically evaluate each item based on its usefulness, frequency of use, and contribution to workflow efficiency. Necessary items are those that directly support daily tasks, promote safety, or align with organizational objectives. Unnecessary items include obsolete tools, expired materials, excess inventory, and items that have accumulated over time but are no longer needed for day-to-day operations. The goal is to streamline the work area by removing unnecessary items, reducing clutter, and creating a more organized and efficient workspace.

Types of unnecessary items

Some of types of unnecessary items are:

- Defective or excess unneeded items that accumulate
- Outdated or broken jigs and dies
- Worn-out bits, inserts

- Outdated or broken tools or inspection equipment
- Old rags and other cleaning supplies
- Electrical tools/equipment with broken cords
- Outdated posters, signs, notices, and memos
- Place “Red tag” for categorization of items to identify unnecessary items
- Move unnecessary items(broken tools, obsolete jigs and fixtures, scrap and excess raw material etc.) to central stored area
- Free up valuable floor space (Space utilization)

Set in Order/ seiton

Definition of set in order

Set in order means arranging necessary items so that they are easy to use and labeling them so that anyone can find them and put them away. The key word in this definition is “anyone”. Set in order can be implemented only when the first pillar- sort is done first. No matter how well you arrange items, set in order can have little impact if many of the items are unnecessary and not sorted. Similarly, if sorting is implemented without setting in order, it is much less effective. Where necessary items should be placed should be made clear for anyone to immediately find them and return them easily. Hence, Sort and Set in order work best, when they are implemented together. To effectively implement the 5S methodology, the Set in Order phase follows the completion of the Sort phase, ensuring that unnecessary clutter is eliminated before organization begins. Set in Order aims to establish a standardized and consistent system for storing and retrieving tools and materials. This involves arranging items in a manner that optimizes accessibility and efficiency. The user must devise this system based on the frequency of use and the associated processes. Setting in order involves organizing items in a logical manner, ensuring they are easily found and identifiable. Once unnecessary items are removed, the remaining ones are arranged to facilitate easy access and immediate recognition of their proper place.

This strategic organization minimizes wasted time and motion, streamlines workflow processes, and enhances overall efficiency within the workspace.



Figure 9: Set in order example

Implementing set in order activity

In implementing set in order pillar, we use visual controls so that communications became easy and smooth. For example, we can visually know where items are placed and where to return them and so on. A visual control is any communication device used in the workplace that tells us at a glance how work should be done. Through visual controls, information such as where items belong, how many items should be placed there, what the standard procedure is for doing something, the status of work in process etc. can be communicated.

Procedures for Set in order

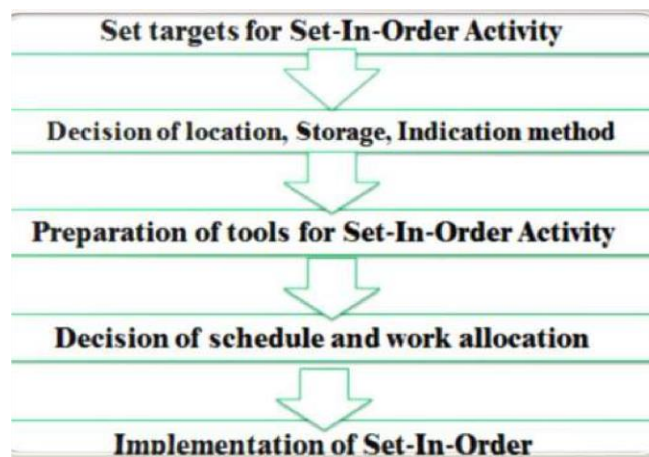


Figure 26: Set in order example

There are some principles for deciding best locations for tools and equipment. Jigs, tools and dies differ from materials, equipment, machinery and parts in that they must be put back after each use. Some of the principles for jigs, tools and dies also apply to parts, equipment, and machinery. These are:

- Locate items in the workplace according to their frequency of use. Place frequently used items near the place of use. Store infrequently used items away from the place of use.
- Store items together if they are used together, and store them in sequence in which they are used.
- Make storage places larger than the items stored there so that they are physically easy to remove and put back.
- Store tools according to function or product. Function-based storage means storing tools together when they have similar functions. This works best for job-shop production. Product-based storage means storing tools together when they are used on the same product. This works best for repetitive production

Some guidelines to consider:

- If items are used together, store them together.
- Put frequently used items closest to the user.
- Place items so the user doesn't need to bend or twist much to access them.
- Arrange tools and materials in order of use.
- Identify the best location for each essential item
- Place each essential item in its assigned location
- After use immediately return each essential item to its assigned location
- Regularly check that each essential item is in its assigned location
- The Set in Order step utilizes several strategies to accomplish its goals

Three Rules for Storage Space

- Get rid of all unnecessary items
- Decide proper storage layout/classification
- Standardize names

Priority	Frequency of use	
Low	Once a year	Throw away Store in distant place
Average	Once every 2-6 months Once a month Once a week	Store together Somewhere in the office
High	Once a day Once an hour	Carry or keep at your workplace

Example of “Setting” activities

- Labeling, numbering, zoning for clear identification of storage areas to keep necessary items
- Set necessary items matching with workflow to minimize unnecessary movement and transportation time

Labels and Signs

A key component of any organizational program, labeling is the easiest way to quickly and visually identify proper placement of tools, materials, and equipment. For example, drawers of tool chests can be labeled with their contents so employees can easily find what they need. Animal feed in stores can be labeled so that they can be easily accessible whenever needed. The floor can even be labeled indicating where trash cans, machinery, and other equipment should be placed so these things always find their way back to where they belong



Fig 17. Labels and Signs

once everything is properly labeled; it's easier for employees to keep 5S in focus on a daily basis. If they ever forget the location of something, the answer is right in front of them.

Line Marking

Painted or taped lines are often associated with safety (pedestrian paths, forklift and equipment paths, etc.), but they are also very useful for marking work areas, as well as locations for pallets, raw materials, finished goods, shipping, and other static locations. By marking the boundaries of these areas, you'll make it easier for employees and visitors to make sense of space.



Fig 18. Line Marking

These techniques can be used for work cells of any kind. They will improve workflow and result in improved productivity. Additionally, misplaced items and equipment are easy to spot.

Tool/shadow board

Tool outlining means creating a visual outline of your tool so you can quickly return it to its proper home. For pegboards and other hanging tool systems, this is done by placing painted or vinyl cutouts of your tools behind those tools. Vinyl tool outlines work well since they are easy to apply and require no maintenance.

This method is called shadow boarding. These methods of organizing tools are simple but effective. They make organization more visual.

**Workplace layout optimization:**

- **Flow Analysis:** Analyze the flow of work within the workspace to identify inefficiencies or bottlenecks. Observe how materials and workers move through the space and look for opportunities to streamline processes.
- **Zone Segregation:** Divide the workspace into zones based on the type of work being performed or the frequency of use. This allows for better organization and prevents congestion by keeping similar activities grouped together.
- **Ergonomic Considerations:** Design workstations and layouts with ergonomics in mind to minimize strain and fatigue on workers. Ensure that tools and materials are easily accessible without requiring excessive reaching or bending.
- **Flexibility and Adaptability:** Create layouts that can be easily adjusted or reconfigured to accommodate changes in workflow or production requirements. This may involve using modular furniture or mobile workstations that can be rearranged as needed.

- **Safety Compliance:** Ensure that the layout adheres to safety regulations and guidelines, with clear pathways for movement and adequate space around machinery
- and equipment. Regularly review and update the layout to address any new safety concerns or hazards.

Some of the strategies used in this phase are

- Assign positions for all equipment, tools, parts and materials.
- Store items by frequency of use and at the point of use.
- Organize normal items in modular cabinets, drawers, shelves and racks.
- Organize small items into storage bins, boxes and cans.
- Organize large items in standard well-labeled floor or outside areas.
- Change to an open storage system. Eliminate locks and covers as they hide secret inventory and lost parts and tools.
- Improve wiring organization.
- Place shared tools on shadow boards.
- Use different colored paint or tape to assign tools for different departments or individuals.
- Use functional carts when conducting changeovers, maintenance or cleaning.
- Ensure safety equipment is easily accessible.
- Keep clear standardized labels on work areas, doors, shelves, boxes, bins and hangars.
- Use tape or paint to mark and label floors, isles, storage areas, parking areas, delivery areas, staking areas, and the locations of safety equipment. □ Stack pallets correctly
- and ensure FIFO is being followed.
- Use colors and labels to define inventory levels and reorder triggers. □ Use a tool checklist to ensure all the proper tools are available.

Example of Set in Order



Before



After



Before



After

Shine/ Seiso

The shine step of 5S is a crucial part of the 5S methodology that focuses on cleanliness and organization. The objective of the shine step is to thoroughly clean and remove any dirt, dust, or debris from the work area, equipment, and tools. By maintaining a clean and organized workspace, it helps to improve safety, efficiency, and productivity.

The shine step involves tasks such as sweeping, mopping, dusting, and wiping down surfaces. It also includes regular maintenance and inspection of equipment to ensure they are in good working condition. Regular cleaning helps to prevent equipment breakdowns, reduce errors, and improve overall work quality.

Overall, the shine step of 5S helps to create a clean and organized work environment that promotes employee morale and productivity.












Cleaning and Maintenance Standards:

Figure 10: Shining example and tools

- **Establish Clear Standards:** Define the level of cleanliness expected in different areas (e.g., workstations, common areas, restrooms) according to industry regulations and company policies.
- **Documentation:** Maintain written guidelines outlining specific cleaning procedures, including the frequency of tasks and the products/tools to be used.
- **Training:** Train staff on proper cleaning techniques, safety protocols, and the importance of maintaining hygiene standards.
- **Inspection and Audits:** Regularly inspect premises to ensure compliance with cleaning standards. Conduct periodic audits to identify areas for improvement.

- **Adaptability:** Remain flexible to adjust cleaning protocols based on changing needs, such as during peak hours or in response to special events.
- **Daily Cleaning Routines and Responsibilities:**
- **Assigned Tasks:** Clearly define daily cleaning tasks for each staff member or team, including responsibilities for specific areas or equipment.
- **Schedule:** Develop a cleaning schedule that ensures all necessary tasks are completed each day without disrupting workflow.
- **Checklists:** Provide employees with detailed checklists outlining tasks to be performed, with checkboxes for verification.
- **Supervision:** Assign a supervisor or team leader to oversee cleaning activities and ensure tasks are completed to standard.
- **Feedback Mechanism:** Encourage staff to report any maintenance issues or cleaning deficiencies promptly, allowing for swift resolution.
- **Creating a Safe and Pleasant Work Environment:**
- **Safety Protocols:** Implement safety measures to prevent accidents or injuries, such as proper storage of cleaning chemicals, use of personal protective equipment (PPE), and adherence to ergonomic guidelines.
- **Comfortable Facilities:** Maintain a comfortable indoor environment through temperature control, adequate ventilation, and proper lighting.
- **Aesthetic Appeal:** Keep the workspace visually appealing by minimizing clutter, organizing supplies, and incorporating decorative elements where appropriate.
- **Employee Well-being:** Consider amenities like rest areas, hydration stations, and healthy snack options to promote employee comfort and wellness.
- **Communication:** Foster open communication channels for employees to voice concerns or suggestions regarding the work environment, demonstrating a commitment to their satisfaction and safety.

	Monday	Tuesday	Wednesday	Thursday
				
				
				

A

Figure 11: duty schedule showing which tasks must be performed, when, and by whom

Standardize

Keeping the workplace clean and tidy is a real challenge and can only be achieved if standards are established and adhered to. The standardize phase involves implementing clear guidelines for maintaining cleanliness and orderliness. Over time, these standards should be updated to streamline 5S practices, ensuring continued simplicity and ease of implementation.

Developing and Documenting Standardized Work Procedures:

- **Initial Assessment:** Begin by assessing the current state of the workplace to identify areas for improvement and establish baseline standards.
- **Define Procedures:** Develop clear, step-by-step procedures for each stage of the 5S methodology (Sort, Set in order, Shine, Standardize and Sustain).
- **Documentation:** Document these procedures in a comprehensive manual or guidebook accessible to all employees. Include visual aids, such as diagrams or photos, to enhance understanding.
- **Standardization Criteria:** Establish criteria for what constitutes successful implementation of each 5S stage, ensuring consistency across departments or teams.
- **Continuous Improvement:** Encourage ongoing refinement of procedures based on feedback from employees and observations of effectiveness in practice.

Training and Communication on 5S Standards:

- **Employee Training:** Provide thorough training sessions to familiarize employees with the principles and objectives of the 5S methodology.
- **Role-Specific Training:** Tailor training programs to address the specific roles and responsibilities of different staff members within the organization.
- **Interactive Workshops:** Conduct interactive workshops or hands-on simulations to reinforce key concepts and practical application of 5S principles.
- **Communication Channels:** Establish regular communication channels, such as meetings, newsletters, or digital platforms, to disseminate information about 5S initiatives and updates.
- **Leadership Support:** Ensure that organizational leaders actively endorse and promote the importance of 5S practices, leading by example in their own workspaces.
- **Monitoring and Auditing Compliance with 5S Practices:**
- **Regular Inspections:** Schedule routine inspections to assess adherence to 5S standards across different areas of the workplace.

- **Checklists and Metrics:** Develop comprehensive checklists or metrics to evaluate performance against established 5S criteria.
- **Auditing Procedures:** Conduct formal audits to verify compliance with standardized work procedures and identify areas requiring corrective action.
- **Feedback Mechanism:** Encourage employees to provide feedback on 5S implementation, including suggestions for improvement or recognition of exemplary practices.
- **Continuous Evaluation:** Continuously monitor progress and track key performance indicators related to 5S practices, adjusting strategies as needed to maintain or improve compliance levels.

Sustain

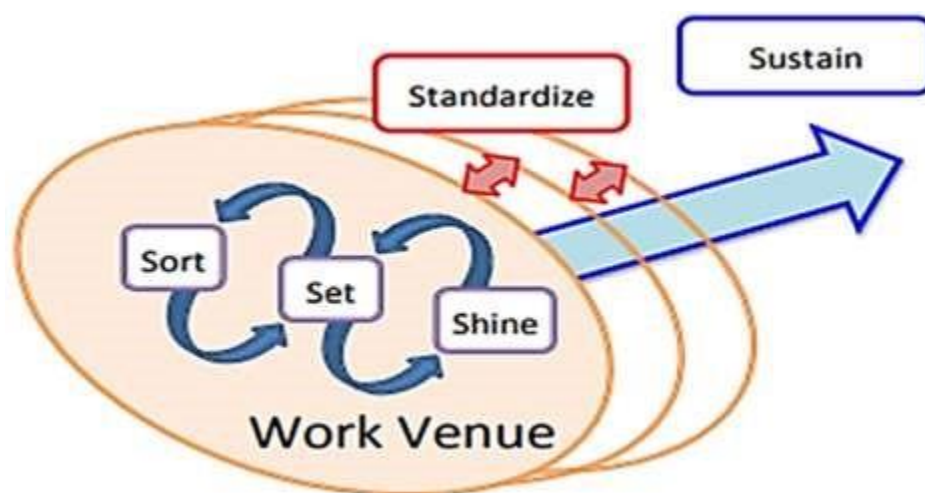


Fig 27. Consistent practice of 5S

Once the first four phases have been implemented, attention must shift to sustaining what has been accomplished. **Sustaining** is the disciplined application of the first four „S“ practices to ensure the effectiveness and longevity of the 5S program. This phase proves to be one of the most challenging parts of implementation, as many companies have found themselves with cluttered and dirty workplaces again after their initial attempt to implement 5S.

5S has a tendency to fail when there is a lack of ownership from the top and when leadership does not place continuous focus on it. Leadership must buy-in and be personally committed to ensure the success of the 5S program. They must establish a culture where 5S excellence is expected and nothing less is tolerated. Adequate planning, training, monitoring, and a formal system of accountability must exist in order for the 5S program to ensure its successful continuation.

Creating a Culture of Continuous Improvement:

- **Employee Involvement:** Foster a sense of ownership and involvement among employees by encouraging their active participation in identifying areas for improvement.
- **Feedback Mechanisms:** Establish channels for employees to provide feedback on current processes and suggest ideas for enhancement.
- **Kaizen Events:** Organize periodic Kaizen (continuous improvement) events focused on specific areas or processes, bringing together cross-functional teams to brainstorm and implement improvements.
- **Training and Education:** Offer training sessions and workshops on continuous improvement methodologies, empowering employees with the skills and mindset necessary to drive positive change.
- **Leadership Support:** Ensure that organizational leaders actively champion the importance of continuous improvement, allocating resources and providing guidance to support ongoing initiatives.

Reward and Recognition Systems for 5S Adherence:

- **Performance Metrics:** Define clear metrics for evaluating adherence to 5S principles, such as audit scores, efficiency gains, or cost savings.
- **Incentive Programs:** Implement incentive programs that reward individuals or teams for demonstrating exemplary adherence to 5S standards. This could include monetary rewards, recognition ceremonies, or other incentives tailored to organizational culture.
- **Peer Recognition:** Encourage a culture of peer recognition, where employees acknowledge and celebrate each other's contributions to maintaining a clean and organized workplace.
- **Continuous Feedback:** Provide regular feedback to employees on their performance related to 5S practices, highlighting areas of improvement and recognizing achievements.
- **Public Acknowledgment:** Showcase examples of 5S success stories and best practices across the organization, reinforcing the value of adherence to 5S principles.

Incorporating 5S Principles into Daily Routines and Habits:

- **Training and Reinforcement:** Integrate 5S training into onboarding processes for new employees and provide ongoing reinforcement through regular reminders and refresher courses.

- **Visual Management:** Use visual cues such as signage, color coding, and floor markings to remind employees of 5S principles and facilitate adherence to standardized processes.
- **Daily Huddles or Stand-Ups:** Start each workday with brief huddles or stand-up meetings to review priorities, reinforce 5S expectations, and address any immediate concerns.
- **Gemba Walks:** Conduct regular Gemba walks (on-site observations) to assess adherence to 5S principles firsthand, providing opportunities for coaching and reinforcement.
- **Lead by Example:** Encourage leaders and supervisors to model desired behaviors by consistently following 5S principles in their own workspaces and interactions.

Self-Check Questions: 6

1. List the five phases of 5S and briefly explain each one.
2. What are the main objectives of the "Sort" phase (Seiri) in the 5S methodology?
3. Describe the process of red-tagging and its significance in the "Sort" phase.
4. Explain the importance of the "Set in Order" phase (Seiton) and how it is implemented.
5. Outline the strategies for maintaining cleanliness and organization in the "Shine" phase (Seiso).
6. What is the purpose of the "Standardize" phase in 5S, and how are standardized work procedures developed?
7. Discuss the challenges and strategies for sustaining the 5S program in the "Sustain" phase.

3.5 Implementing and Sustaining 5S in the Workplace

Implementing and sustaining 5S in the workplace involves a systematic approach to organization, cleanliness, and efficiency. Here's a breakdown of key steps:

Step 1: Initial Assessment and Planning:

- **Assess Current State:** Evaluate the current workplace conditions, identify areas for improvement, and determine the scope of the 5S implementation.
- **Set Objectives:** Define clear objectives and targets for 5S implementation, aligning them with organizational goals and priorities.
- **Create Implementation Plan:** Develop a detailed plan outlining specific tasks, timelines, resource requirements, and responsibilities for each stage of the 5S process.

Step 2: Training and Education:

- **Employee Training:** Provide comprehensive training to all employees on the principles, benefits, and techniques of 5S.
- **Hands-on Workshops:** Conduct hands-on workshops and simulations to reinforce learning and demonstrate practical application of 5S concepts.
- **Leadership Engagement:** Ensure active involvement and support from organizational leaders to champion the 5S initiative and promote employee buying.

Step 3: Implementing 5S Stages:

Sort (Seiri): Identify and remove unnecessary items from the workplace, categorizing items as necessary or unnecessary based on their value and frequency of use.

Set in Order (Seiton): Organize remaining items in a systematic manner, assigning designated locations for storage and ensuring easy accessibility.

Shine (Seiso): Establish cleaning routines and procedures to maintain cleanliness and orderliness in the workplace, promoting a safe and hygienic environment.

Standardize (Seiketsu): Develop standardized work procedures and visual controls to sustain the gains achieved through Sort, Set in Order, and Shine stages.

Sustain (Shitsuke): Implement mechanisms to sustain the 5S practices over the long term, including regular audits, performance monitoring, and continuous improvement initiatives.

Step 4: Monitoring and Continuous Improvement:

- **Regular Audits:** Conduct periodic audits to assess adherence to 5S standards, identify areas of non-compliance, and track progress over time.
- **Feedback Mechanisms:** Solicit feedback from employees on the effectiveness of 5S practices and opportunities for improvement.
- **Kaizen Events:** Organize Kaizen events to facilitate continuous improvement efforts, encouraging cross-functional collaboration and problem-solving.

Step 5: Recognition and Reward Systems:

- **Recognition Programs:** Implement recognition programs to acknowledge and reward individuals or teams for their contributions to 5S adherence and improvement initiatives.

- **Incentives:** Offer incentives such as bonuses, certificates, or extra time off to motivate employees to actively participate in 5S activities.
- **Peer Recognition:** Foster a culture of peer recognition where employees acknowledge and appreciate each other's efforts in maintaining a clean and organized workplace.

Step 6: Documentation and Communication:

- **Documentation:** Maintain comprehensive documentation of 5S procedures, standards, audit results, and improvement initiatives for reference and future training.
- **Communication Channels:** Establish effective communication channels to disseminate information, updates, and best practices related to 5S implementation across the organization.

3.6 Strategies for Overcoming Challenges in Sustaining 5S practices:

- **Leadership Commitment:** Secure commitment and support from organizational leaders to prioritize and sustain 5S practices, allocating resources and providing visible leadership.
- **Employee Engagement:** Foster employee ownership and accountability for 5S practices through involvement in decision-making, training, and recognition programs.
- **Continuous Training:** Provide ongoing training and reinforcement of 5S principles to ensure employees understand their roles and responsibilities in maintaining a clean and organized workplace.
- **Feedback Mechanisms:** Establish feedback mechanisms for employees to report issues, suggest improvements, and participate in problem-solving related to 5S practices.
- **Regular Audits and Inspections:** Conduct regular audits and inspections to assess compliance with 5S standards, identify areas for improvement, and track progress over time

Unit Summary

- **5S** is a process and method for creating and maintaining an organized, clean, and high performance workplace. It enables anyone to distinguish between normal and abnormal conditions at a glance. It is the foundation for continuous improvement, zero defects, cost reduction, and a safe work area.
- 5S is a systematic way to improve the workplace, our processes, and our products through production line employee involvement.
- **Sort (Seiri):** Identify and remove unnecessary items from the workplace, categorizing items as necessary or unnecessary based on their value and frequency of use.
- **Set in Order (Seiton):** Organize remaining items in a systematic manner, assigning designated locations for storage and ensuring easy accessibility.
- **Shine (Seiso):** Establish cleaning routines and procedures to maintain cleanliness and orderliness in the workplace, promoting a safe and hygienic environment.
- **Standardize (Seiketsu):** Develop standardized work procedures and visual controls to sustain the gains achieved through Sort, Set in Order, and Shine stages.
- **Sustain (Shitsuke):** Implement mechanisms to sustain the 5S practices over the long term, including regular audits, performance monitoring, and continuous improvement initiatives.
- **Leadership Commitment:** Secure commitment and support from organizational leaders to prioritize and sustain 5S practices, allocating resources and providing visible leadership.
- **Employee Engagement:** Foster employee ownership and accountability for 5S practices through involvement in decision-making, training, and recognition programs.
- **Employee Training:** Provide comprehensive training to all employees on the principles, benefits, and techniques of 5S.

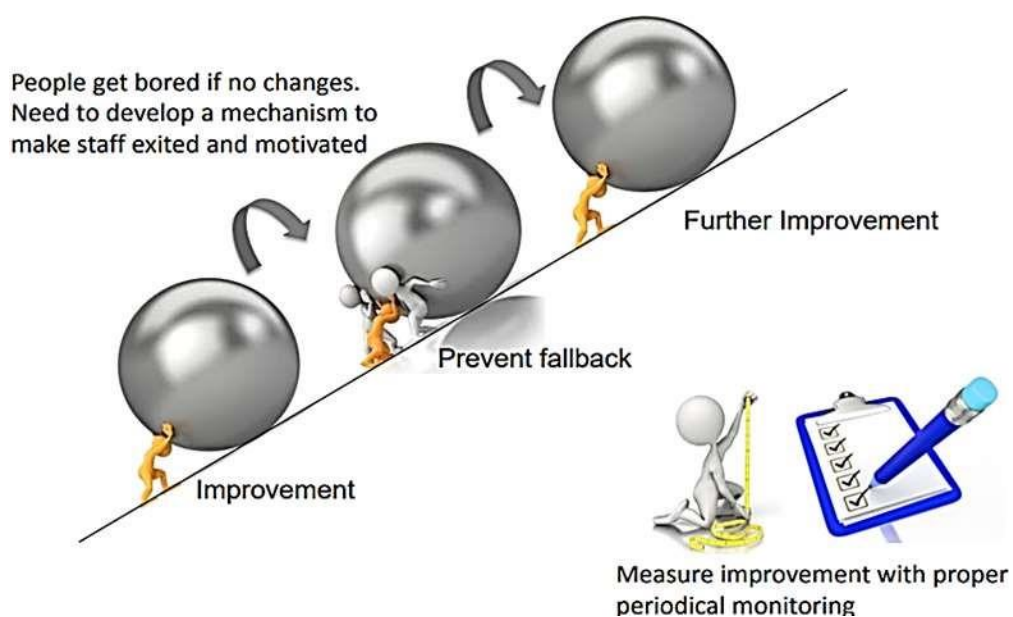


Fig 28. Sustain activities

Unit Review Questions

Part I. Answer the following questions correctly

1. One of the following is used to implement the third pillar of 5s- shine?
 - A. Brush
 - B. Hammer
 - C. Hack saw
 - D. Chipping hammer
2. All necessary and unnecessary items are categorized in the sorting activities
 - A. True
 - B. False
3. Which one is an example of shine activities?
 - A. Daily sweeping and mopping of floor, bath room, corridor etc.
 - B. Regular cleaning and maintenance of equipment and tools
 - C. Periodical check for changes in equipment and the service area
 - D. All
4. Red tag tool is used for sort activity when the items are necessary
 - A. True
 - B. False
5. . Which one is NOT a benefit of Shine?
 - A. Customer satisfaction
 - B. Happier employees
 - C. Improved quality
 - D. inventory reduction
6. 5S should be implemented by only one person per department to save time and avoid confusion.
 - A. True
 - B. False
7. Which of the following is not an advantage of implementing 5S technique?
 - A. To improve work efficiency
 - B. To standardize work practices
 - C. To improve work discipline
 - D. To create a dirty workplace

8. Which of the following from the 5S technique means „to separate out all unnecessary things and eliminate them“?
- A. Sort C. Sustain
- B. Standardize D. Shine
9. Which of the following is the correct order of 5s implementation?
- A. Sort , sustain , shine , standardize, set in order
- B. Sort , standardize , shine, set in order , sustain
- C. Sort , shine, set in order, standardize , sustain
- D. Sort, set in order, Shine, standardize, sustain

Part II. Matching

A

1. Sort
2. Straighten
3. Shine
4. Standardize
5. Sustain

B

- A. Clean to inspect
- B. Create standards so abnormalities are easily recognized.
- C. Apply positive tension to ensure gains are maintained.
- D. Get rid of the things you no longer need.
- E. Get a place for everything and put everything in its place.

Project Work

From your school compound select one from the following work place and apply 5s a. Office

- A. Library
- B. Store
- C. Department
- D. Laboratory

Follow the following procedure for implementing 5s

1. Take a picture of the current status of your workplace.
2. Sort to separate anything that is needed and necessary from what is not needed.
3. Organize the things you need so that there is a place for everything and everything has a place. You should be able to find anything in just a few seconds.
4. Clean the workplace and get rid of things that make it difficult to maintain cleanliness, such as boxes on the floor that prevent you from being able to clean the entire surface label them and store them in labeled drawers, instead.
5. Take a second picture after the entire day's work, for review.

Answer to self-check questions

Answer to self-question 5

1. The 5S methodology organizes workplaces for productivity, safety, and quality.
2. The five steps of 5S are: Sort, Set in Order, Shine, Standardize, and Sustain.
3. Implementing 5S improves safety, reduces downtime, and enhances productivity.
4. 5S fosters a foundation for continuous improvement by creating an organized work environment.
5. 5S and Kaizen work together to promote ongoing efficiency and innovation in organizations.

Answer to self-question 6

1. The five phases of 5S are Sort, Set in Order, Shine, Standardize, and Sustain. They involve organizing the workplace, improving efficiency, cleanliness, and sustaining these practices.
2. The "Sort" phase aims to eliminate unnecessary items from the workplace to reduce clutter, optimize space, and enhance efficiency.
3. Red-tagging involves identifying and evaluating potentially unneeded items in the workplace using red tags. It helps in deciding whether to keep, dispose of, or relocate items.
4. "Set in Order" organizes necessary items for easy access and efficient workflow. It involves visual controls, labeling, and arranging items based on frequency of use.
4. The "Shine" phase focuses on cleanliness and maintenance to improve safety, efficiency, and morale in the workplace. It includes tasks like sweeping, dusting, and regular equipment maintenance.
5. "Standardize" establishes clear guidelines and procedures for maintaining cleanliness and organization. It involves documenting processes, providing training, and ensuring consistency.
7. Sustaining the 5S

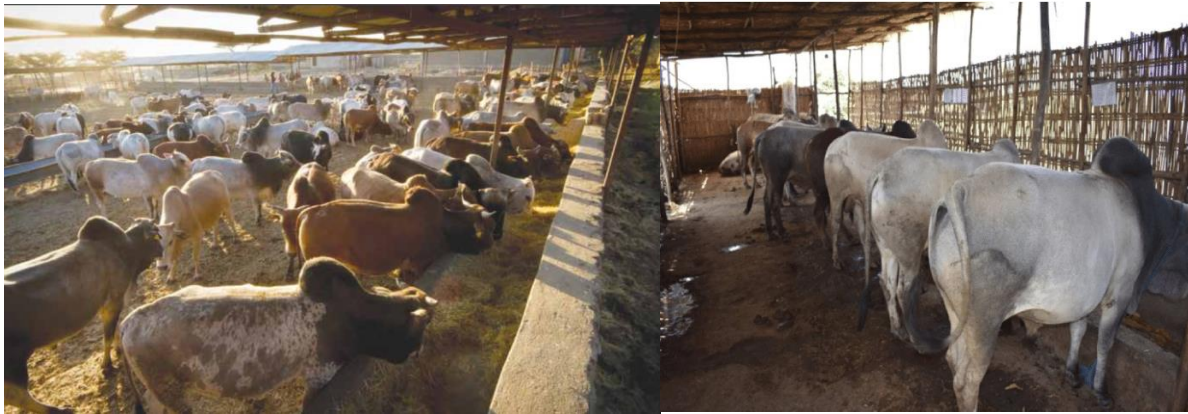
program requires ongoing commitment from leadership, employee involvement, regular audits, and continuous improvement efforts to maintain cleanliness, organization, and efficiency over time

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MODULE III

Cattle Fattening Practices



Contents

No		Contents	Page
		Module Description	183
1		UNIT 1: Prepare for Cattle Fattening	184
	1.1	Required Materials, Tools and Equipment	185
	1.2	House and Housing Facilities	189
	1.3	Techniques of Loading and Unloading	192
		Unit Summary	197
2		Unit 2: Select Cattle for Fattening	199
	2.1	Cattle Selection Criteria	199
	2.2	Length of Fattening Period and Profitability	207
		Unit Summary	212
		Unit Review Questions	213
3		Unit 3: Cattle Fattening Practice	215
	3.1	Fattening Systems	216
	3.2	Feeding Fattening Cattle	224
	3.3	Growth Monitoring	233
	3.4	Fattening Cattle Health Care	237
	3.5	Record Keeping	240
		Unit Summary	242
		Unit Review Questions	242
		References	246

Module Description

This module covers the knowledge, skills and attitude required to undertake Cattle fattening that able to prepare for cattle fattening, to select cattle for fattening carryout fattening, feed and feeding for fattening animals and monitor performance of feedlots to aid farming community and enterprises.

Cattle fattening, also known as animal finishing, is the process of raising and feeding farm animals, such as cattle and shoat, in a specialized manner to promote rapid weight gain and improve the quality of their meat. It begins with the selection of healthy young animals, typically weaned calves, lambs/kids, which have good growth potential. These animals are housed in clean, well-ventilated pens or barns that provide protection from extreme weather conditions. The key to cattle fattening lies in providing a well-balanced and high-energy diet, consisting of concentrate feeds like grains, oilseeds, and protein supplements, along with good-quality forage such as hay or silage. Regular monitoring of growth, feed intake, and overall health is essential, with adjustments made to the diet and feeding regimen as needed. Cattle growers closely track the animals' weight gain and make sure they reach the desired market weight. Once that is achieved, the animals are sold to slaughterhouses or meat processing facilities. Fattening cattle, sheep and goat is one kind of livelihood option with better income for farmers in urban and rural areas.

UNIT 1

Prepare for Cattle Fattening

Learning out come

After completion of this unit, the students will be able to:

- Identify Require materials, tools and equipment
- Prepare house and housing facilities
- Use correct manual handling techniques for loading and unloading materials

Key terms

- Loading
- Unloading

Unit Introduction

Why fattening cattle is important?

Cattle fattening is a practice that involves raising animals to achieve a desired weight or condition for sale or slaughter. It is a process of feeding and managing cattle in a way that promotes efficient weight gain and optimal muscle development. Cattle farmers undertake fattening to meet market demands for meat products and to maximize profitability.

During the fattening period, animals are provided with a carefully balanced and nutritious diet to promote rapid growth and increase muscle mass. This typically involves a combination of high-quality forages, grains, concentrates, and supplements, tailored to meet the specific nutritional needs of the livestock species being raised. The feeding program aims to provide the right amount of energy, protein, vitamins, and minerals to support healthy growth, while also considering factors such as age, breed, and market requirements.

Proper housing and facilities are essential for cattle fattening. Depending on the species, this may include barns, sheds, pens, or other structures that provide shelter, ventilation, and adequate space for the animals.

Access to clean water, comfortable bedding, and appropriate waste management systems are also important to ensure the well-being and health of the animals.

Monitoring the health and growth of the animals is a crucial aspect of cattle fattening. Regular observations and assessments are made to identify any signs of illness or nutritional deficiencies. Vaccinations, deworming, and other preventive measures are implemented to maintain the overall health and welfare of the animals.

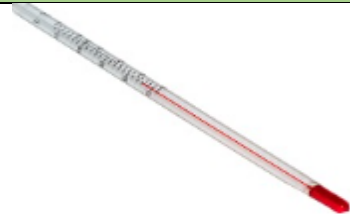
Cattle fattening requires diligent record-keeping to track the progress of individual animals, including weight measurements, feed consumption, and health observations. This data helps farmers make informed decisions about feed adjustments, health management, and market timing.






Once the animals have reached the desired weight or condition, they are marketed and sold. This may involve selling them at local auctions, directly to processors or wholesalers, or establishing direct relationships with individual buyers. Effective marketing strategies, such as advertising and promotion, help attract potential customers and ensure a profitable sale.






Successful cattle fattening operations require continuous learning, adaptation, and improvement. Staying updated with industry trends, best practices, and advancements in nutrition and management techniques is essential to optimize production efficiency and profitability. Farmers may seek advice from experts, attend educational programs, and collaborate with other experienced producers to enhance their knowledge and skills in cattle fattening.

1.1. Required Materials, Tools and Equipment

Table 1: Materials, tools and equipment used for fattening

S/N	Materials	Picture	Uses/Functions
1	Thermometer		Taking body temperatures of farm animals

2	Burdizzo		Used in bloodless method of castration.
3	Trimming knife		Cutting short the overgrown hooves.
4	Elastrator		Stretching rubber ring during castration, dehorning and docking of lambs.
5	Iron dehorner		Applies heat on the horn bud to prevent growth of horns.
6	Nose ring		Used to restraining the bull

7	Trocar and cannula		Relieving a bloated animal of gases particularly ruminants.
8	Ear notcher		Making ear notches in cattle.
10	Rope		Tying or tethering animals.
11	Cattle crates, or cattle crushes		To ensure the safety of both the animal and the person during loading and unloading
12	Water troughs		Used to watering the animals

14	Feed through		Used to feeding the animals
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Self-check 1

- Which of the following is NOT a common type of fencing used for beef cattle enclosures?
 - Barbed wire
 - Electric fencing
 - Chain-link
 - Wooden posts and rails
- Which of these tools is primarily used for grooming and maintaining the appearance of beef cattle?
 - Sorting stick
 - Hoof trimmer
 - Cattle brush
 - Syringe
- When it comes to feeding beef cattle, which of these pieces of equipment is used to store and distribute feed?
 - Watering trough
 - Manure spreader
 - Feed bunk
 - d) Silo
- Which of the following is a type of cattle handling facility used for restraining and working with individual animals?
 - Loading ramp
 - Squeeze chute
 - Automatic waterer
 - Feed storage bin
- What is the primary purpose of using ear tags for beef cattle?
 - Identification and record-keeping
 - Veterinary treatment
 - Feeding management
 - Hoof trimming

1.2. House and Housing Facilities

Do we really need housing facilities for cattle fattening?

Cattle housing facilities are essential for providing shelter, comfort, and protection to different types of animals. For cattle, barns are commonly used, offering a covered space with feeding and watering areas, as well as stalls or pens for individual animals. Pasture access is also important for grazing cattle, with fenced areas providing ample grazing and water sources.

Additionally, proper fencing, bedding materials for comfort and waste absorption, and access to clean water sources are crucial considerations when designing cattle housing facilities. It's important to consult with experts, adhere to local regulations, and prioritize the well-being of the animals when constructing and managing these facilities. In tropical countries like Ethiopia, cattle are usually kept in the open air but with fenced place (for predator protection) without suitable and appropriate shelter. And yet many small holder farmers cannot afford the construction of suitable cattle fattening shelter

There are different types of fattening house. These are:

1. **Open sided, single slope roof shed** - This type of housing is most typical of structures used and is suitable for all cattle on the farm. This is the least expensive of new structures and very easy to build. Open sheds should face the south for winter sun and block the prevailing winds. Pole barns of this design can be partitioned for groups of animals without complicated interior construction.

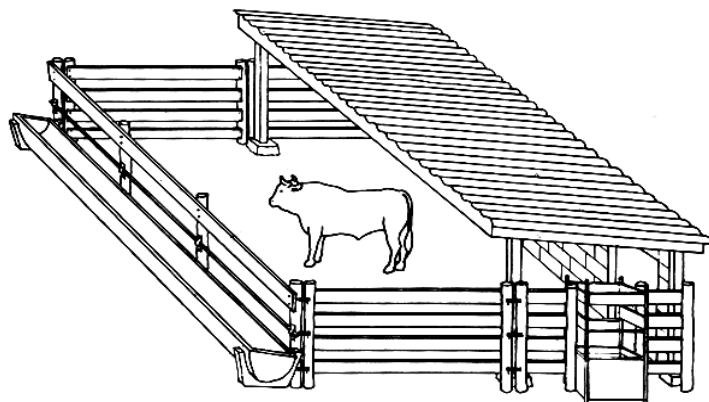


Figure 1. Open sided, single slope roof shed

1. **Open sided, clear span pole shed** - The clear span provides more space for equipment to remove manure and thus any side of the building can be open to the environment. The gable end of the barn is recommended to be open so that the discharge of rain and snow is not over the open side of the building. When the gable end is open, the bays areas are usually deeper and provide more protection from the wind. The back end of the structure may be dark and damp and may need additional design attention for ventilation and lighting. This type of housing is more practical for smaller sized herds (under 20 head of cattle).

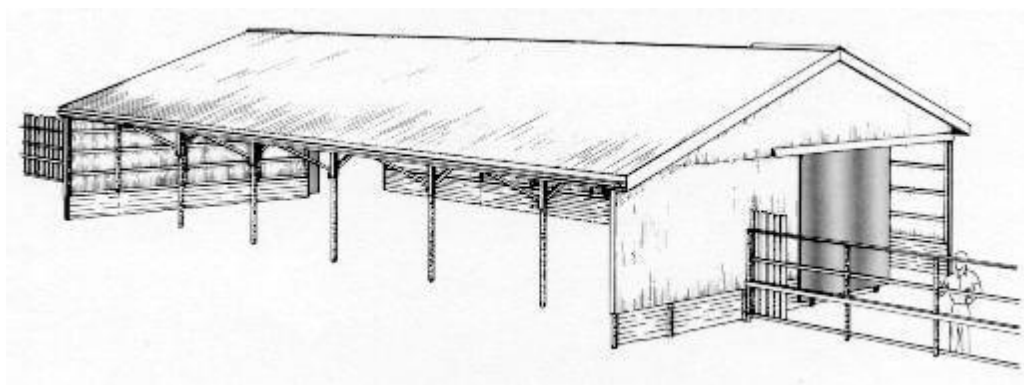


Figure 2: Open sided, clear span pole shed

3. **Hoop Barns** – One of the least expensive structures for housing cattle is the hoop barn. Hoop barns are similar to greenhouses. One disadvantage is the heat and ventilation problems during the summer months, but this should not pose an issue if you are planning on grazing your cattle during the warmer climate months.



Figure 3: Hoop Barns

When preparing the layout, fattening house should think of the following

- Good use of space
- Low costs
- Locally available resources

Depending on the local weather condition, night time resting place can be constructed with one side walled to four side walled housing. The following parameters describe the cattle house:-

Height of the roof - from the floor to the roof can be:

- 2.5 m in high lands.
- 3 m in mid altitude.
- 35 m in low lands.
- Floor with 2.5% slope towards the gutter
- Feed through with 0.4 X 0.4 m³ and water through 0.4 X 0.2 m³

Other than housing the cattle shelter needs to have:

- Shed against strong sunshine
- Treatment crush
- Feed store
- Office
- Guard house
- Isolation room for sick animals, etc.

The preparation of all cattle fattening houses should consider the following points:

Roof cover: Make innovative use of locally available resources including tree sheds, side wall of resident house, making thatched roof (from grasses in our area), etc. When an existing wall is used as one side of the shed, the lean-to roof (with a single slope) is the most convenient arrangement. When a separate shed is constructed away from other structures, a roof sloping in either direction from the center would be best.

Wind break: This protects the cattle from draft wind. Wind breaks can be fences, walls, trees, as well as other natural rocks and slopes.

Drainable floor: The floor shall not lodge in urine and dung. Otherwise, it will cause foot rot. To cover the floor use gravel, sand, and if possible, cover the floor surface with a flat, uniform stone (paved floor). The point in making the floor drainable is that the floor could facilitate easy cleaning of the urine and dung (as well as slurry) and shall be easy to collect the dung for use.

Suitable feeding manger: The feeding manger can be made from locally available resources, with 30-centimeter height so that it prevents spread (spillage) of the feed. Consider the points indicated below under the sub title feeding manger.

Having gutter: The gutter is also called drain or dung channel. Even when the floor is of rammed earth and gravel, it is best to have the gutter made in rubble and cement or brick and cement. If the sides of the gutter are not strong, they will continuously erode into the gutter and proper maintenance of the floor of the standing will be impossible. By making the gutter smooth with cement and sand, cleaning will be convenient and the dung and urine can easily be led into a urine pit or a bio-gas digester outside the shed.

Water reservoir: There should be one reservoir the size of which may depend on the type of available water source.

Slurry collection pit: To collect slurry and other sewerage, a pit shall be made from cement, and the floor draining towards the pit

1.3. Techniques of Loading and Unloading

Loading: is the process is a critical step in the transportation of beef cattle, as it requires careful handling and management to ensure the safety and well-being of the animals.

Unloading: is The of beef cattle is the final step in the transportation process, where the animals are carefully removed from the transport vehicle and moved to their designated holding or processing areas.

Materials:

Bedding - Straw, wood shavings, or other absorbent materials are often used to provide a non-slip, comfortable surface for the cattle during transport.

Partitions/Dividers - These are used inside the transport vehicle to separate cattle into groups and prevent overcrowding.

Ropes/Halters - Used to guide and control individual animals during the loading and unloading process.

Equipment:

Loading Chute/Ramp - A sturdy, raised structure with a gentle incline that allows cattle to walk up and into the transport vehicle.

Transport Vehicle - Specialized livestock trailers or trucks designed to safely carry cattle, often with features like ventilation, drainage, and tie-down points.

Handling Aids - Items like flags, paddles, or electric prods (used sparingly) that help guide the cattle during movement.

Scales - Used to weigh the cattle before and after transport.

Tools:

Sorting sticks/canes - Long, lightweight tools used to gently direct the cattle's movement.

Electric Prod (used with caution) - A device that provides a mild electric shock to encourage cattle movement, used only when necessary.

Gates/Panels - Portable fencing used to create temporary enclosures and guide the flow of cattle.

Shovels/Brooms - For cleaning and maintaining the loading/unloading areas.

Pressure Washer - Used to thoroughly clean and disinfect the loading/unloading areas between uses.

The loading and unloading of beef cattle are essential steps in the transportation of these animals from one location to another, such as from a farm or ranch to a processing facility or auction and from market to farm.

Loading Beef Cattle:

Preparation: The loading area, typically a chute or ramp, is cleaned and inspected to ensure it is safe and secure for the cattle to walk on.

Sorting and Grouping: The cattle are sorted and grouped according to size, age, or other factors to facilitate smooth loading and transportation.

Herding: The cattle are gently herded or moved towards the loading chute or ramp using low-stress handling techniques, such as using flags or paddles to guide them.

Loading: The cattle are encouraged to walk up the chute or ramp and into the transport vehicle, such as a livestock trailer or truck. Care is taken to ensure the cattle are not overcrowded or stressed during this process.

Securing: Once the cattle are loaded, the transport vehicle is inspected to ensure the animals are secured and safe for the journey.

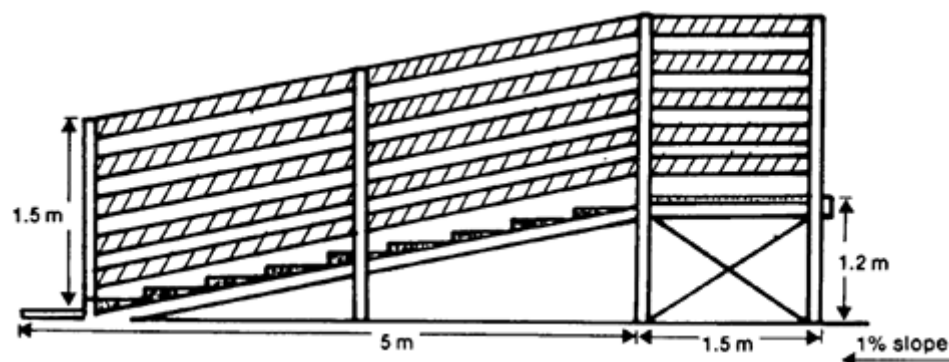


Figure 4. design of cattle loading ramp.

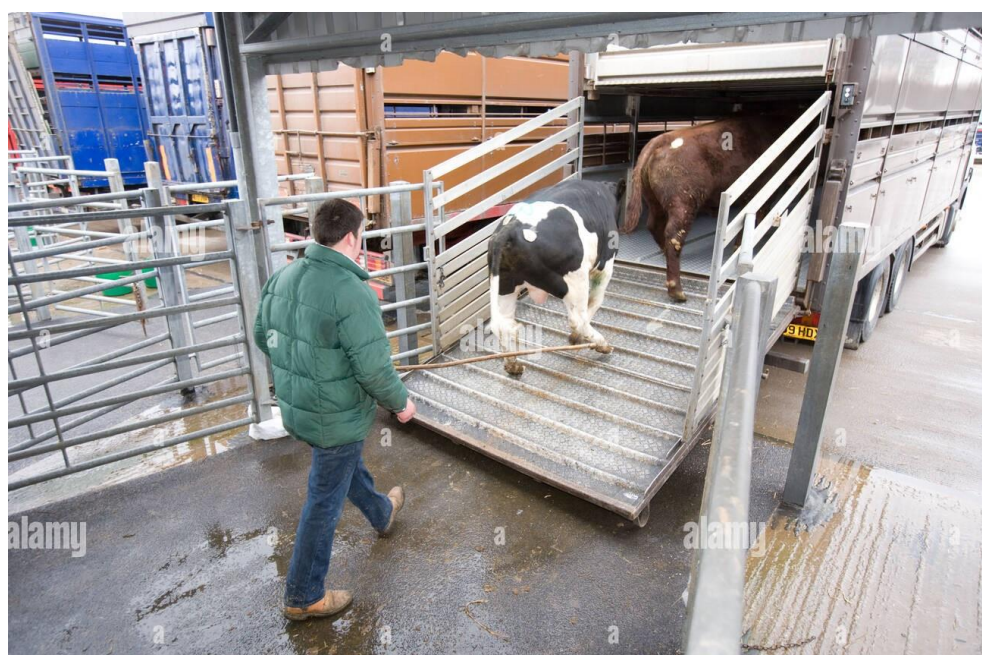


Figure 5. Loading beef cattle

Unloading Beef Cattle:

Preparation: The unloading area is cleaned and inspected to ensure it is safe and secure for the cattle to walk on.

Unloading: The transport vehicle is positioned at the unloading ramp or chute, and the cattle are gently encouraged to walk out of the vehicle and into the unloading area.

Sorting and Counting: As the cattle are unloaded, they may be sorted and counted to ensure all animals have been safely transported.

Inspection: The cattle are inspected for any signs of injury or distress during the transportation process.

Penning: The unloaded cattle are then moved to their designated pens or holding areas for further processing or distribution.

Loading Procedure:

Prepare the Loading Area:

- Clean and inspect the loading chute, ramp, or alley to ensure it is free of any debris or hazards.
- Check that the surface provides good traction for the cattle.
- Ensure all gates, doors, and barriers are functioning properly.

Sort and Group the Cattle:

- Separate the cattle into appropriate groups based on factors like size, age, or temperament.
- This helps facilitate a smooth and efficient loading process.

Herd the Cattle to the Loading Area:

- Use low-stress handling techniques, such as flags, paddles, or the movement of people, to guide the cattle towards the loading chute or ramp.
- Encourage the cattle to move calmly and willingly, avoiding any sudden movements or loud noises.

Load the Cattle:

- As the cattle approach the loading area, guide them up the chute or ramp and into the transport vehicle (e.g., livestock trailer or truck).
- Ensure the cattle have sufficient space to move and stand comfortably, and avoid overcrowding.

Secure the Cattle:

- Inspect the transport vehicle to make sure the cattle are properly secured and safe for the journey.
- This may involve the use of partitions, gates, or other restraints to keep the animals in place.

Unloading Procedure:

Prepare the Unloading Area:

- Clean and inspect the unloading ramp or chute, removing any potential hazards.
- Ensure the surface provides good traction for the cattle.
- Check that all gates, doors, and barriers are functioning correctly.

Position the Transport Vehicle:

- Carefully position the livestock trailer or truck at the unloading ramp or chute.

Unload the Cattle:

- Gently encourage the cattle to walk out of the transport vehicle and into the unloading area using low-stress handling techniques.
- Avoid overcrowding or causing undue stress to the animals during the unloading process.

Sort and Count the Cattle:

- As the cattle are unloaded, they may be sorted and counted to ensure all animals have been safely transported.

Inspect and Pen the Cattle:

- Inspect the unloaded cattle for any signs of injury or distress.
- Move the cattle to their designated pens or holding areas for further processing or distribution.



Figure 6: Transporting beef cattle



Figure 7: Unloading of beef cattle

Self-check 2

1. Which of the following is a key consideration when preparing the loading/unloading facilities?

- A. Ensuring the ramp or chute has secure, non-slip flooring
- B. Providing a shaded area for the cattle
- C. Allowing ample space for the cattle to turn around
- D. All of the above

2. What is the primary purpose of using low-stress handling techniques when loading/unloading cattle?
 - A. To save time and effort
 - B. To minimize the risk of injury to the handler
 - C. To avoid startling or agitating the animals
 - D. To maintain good herd health
3. Which of these is NOT a recommended practice for loading cattle onto a transport vehicle?
 - A. Loading the calmest cattle first
 - B. Providing feed or water incentives
 - C. Using electric prods to force the cattle onto the vehicle
 - D. Maintaining a steady, controlled flow of cattle
4. During the unloading process, what is the importance of ensuring the receiving pens or facilities are ready?
 - A. To minimize the time the cattle spend on the transport vehicle
 - B. To provide a familiar environment for the cattle
 - C. To allow for efficient herd management upon arrival
 - D. All of the above
5. Which of the following is a key safety consideration when loading/unloading beef cattle?
 - A. Wearing appropriate personal protective equipment (PPE)
 - B. Maintaining a safe distance from the cattle
 - C. Having a clear plan and communication with the handlers
 - D. All of the above

Unit Summary

Overall, cattle fattening is a process that involves strategic feeding, management, and marketing to achieve the desired weight or condition of animals for profitable sale or slaughter. It requires attention to detail, careful nutrition planning, proper housing, and consistent monitoring of health and growth parameters to ensure the well-being of the animals and the success of the operation.

Answer key for self-check questions

Self-check 1	Self-check 2
1. C	1. A
2. C	2. C
3. D	3. C
4. B	4. D
5. A	5. D

LAP TEST-1	Performance Test
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Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 1 hour. The project is expected from each student to do it.

Task1: Perform loading animals

Procedures

- Wear PPE appropriately and prepare all necessary materials
- Clean and disinfect materials
- Perform work safely
- Restrain animal
- Loading the animal

UNIT 2

Select Cattle for Fattening

Learning outcomes

Here are some key learning outcomes that can be achieved through understanding and recognizing selecting cattle for fattening:

After the training, students will be able to:

- Select cattle based on selection criteria
- Determine the length of fattening period and profitability
- Understand the importance of selection.
- Identify the characteristics to look for when selecting fattening animals.
- Become familiar with age determination of cattle.

Key Terms

- Breed
- Growth rate
- Feed conversion ratio (FCR)
- Frame size
- Frame score
- Dentition
- Live weight

Unit Introduction

What are the most common cattle selection criteria?

2.1. Cattle Selection Criteria

When selecting cattle for fattening, whether it's cattle, sheep, or goats, there are several criteria to consider. The primary goal is to maximize weight gain and achieve the desired level of finish within a specific time frame. Here are some key selection criteria for cattle fattening:

1. Breed:

Different cattle breeds have varying genetic potential for growth and meat quality. Choose breeds that are known for their good growth rates and have desirable carcass traits. For example, some of the indigenous breeds of Ethiopia like Borana, Horro, Fogera, Begait, Ogaden and others are promising in their beef production performances.

2. Physical condition

Animal should be selected based on appropriate body condition score (BCS: 2-3)

Body condition Score-1:

- Prominent backbone
- Prominent hip and shoulder bones
- Visible skeletal outline
- Clearly visible ribs
- Tail head area recessed

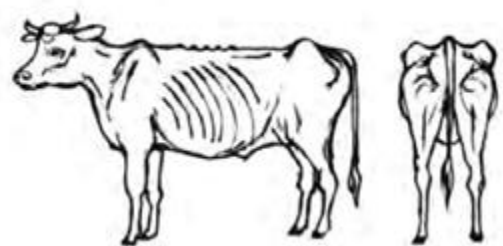


Figure 8. Body condition Score-1:

Body condition Score-2:

- Visible backbone
- Visible shoulder and hip bones
- Faintly visible ribs
- Slightly recessed tail head area

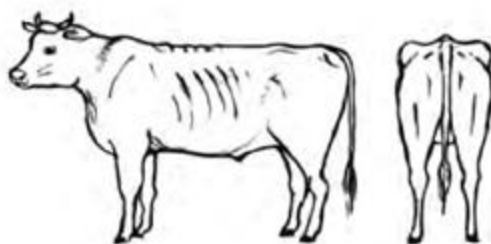


Figure 9. Body condition Score-2:

Body condition Score-3:

- Faintly visible hip bones
- Ribs visible very nominally
- Almost smooth skeletal outline
- Non-recessed tail head area

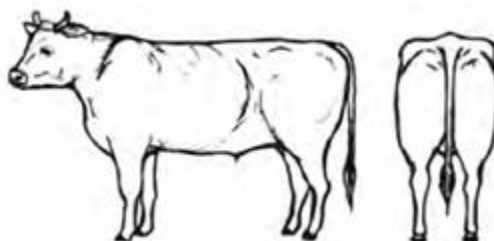


Figure 10. Body condition Score-3:

Body condition Score-4:

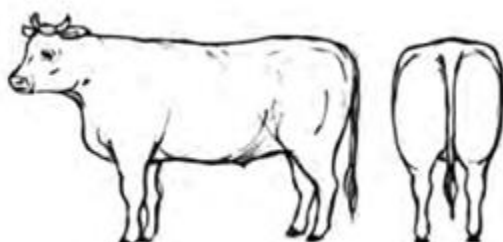


Figure 11. Body condition Score-4:

Body condition Score-5:

- Fat deposited hip bones
- Very well covered ribs
- Very lumpy tail head and Bulging skeletal outline due to fat

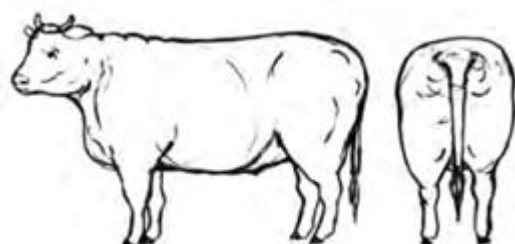


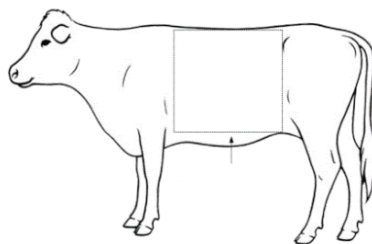
Figure 12. Body condition Score-5:

3. Age should range from 2-2.5 years old (Check the teeth to ensure age)

The age and weight of the cattle at the start of the feeding period can impact the duration and efficiency of the fattening process. Younger animals generally have higher growth rates and better feed conversion efficiency. However, it's important to consider the maturity level that aligns with the desired market specifications, as over-mature animals may have lower carcass quality. Dentition is used to estimate age in live animals and carcass.



Figure 13. Cattle with (clockwise from top left) 2, 4, 6 and 8 permanent teeth. These photos were taken of animals that were 2, 2.5, 3 and 4 years old respectively. Note the worn milk teeth remnants in the top two photos.

4. Body coat covering should be thin**Figure 14.** Thin coat covering**5. Body shape should be square****Figure 15.** Square shaped body structure**6. Frame score**

Cattle with larger frames tend to have a greater capacity for muscle growth and higher feed intake, which can lead to better weight gain. However, it's essential to balance frame size with the desired market specifications, as excessively large-framed animals may produce carcasses that are too large for certain markets or have higher fat cover than desired.

Frame score is a description of an animal's hip height for a given age (in months). It is a measure of the overall size of the animal and is generally related to its growth potential, maturity type and mature size. Frame score is often linked to ease of fattening, though this is also associated with muscling, breed differences and individual genotypes.

Frame score is assessed in a range from 1 to 11 where:

- 1-3: Mature early, grow slowly, fatten at light weights
- 4-5: Moderate maturity, growth, mature size
- 6-7: Late maturity, fast growth, fatten at heavy weights
- 8-11: Very late maturity—extreme frame, very large mature size, difficult to fatten.

The recommended point for height measurement is a point directly over the hips from a level surface (Figure 12). It is measured in centimeters.

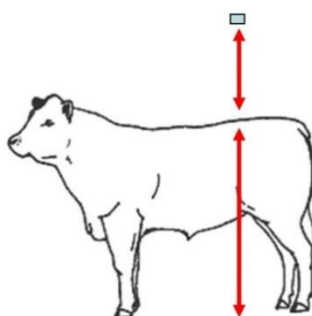


Figure 16. Measurement point for frame score (over point of hip).

Table 2. Male frame scores based on height measurement at the hip (cm)

Age (months)	Bulls—hip height (cm)										
	Frame score										
	1	2	3	4	5	6	7	8	9	10	11
5	85	90	95	100	105	110	116	121	126	131	137
6	88	93	99	104	108	114	119	124	130	135	140
7	92	97	102	107	112	117	122	128	133	138	143
8	95	100	105	110	114	120	125	131	136	141	146
9	98	102	107	113	117	123	128	133	138	144	149
10	100	105	110	115	119	125	130	135	140	146	151
11	102	107	112	117	122	128	133	138	143	148	153
12	104	109	114	119	124	130	135	140	145	150	155
13	106	111	116	121	126	131	137	142	147	152	157
14	108	113	118	123	127	133	138	143	148	154	159

15	109	114	119	124	129	135	140	145	149	155	160
16	110	116	121	126	130	136	141	146	151	156	161
17	112	117	122	127	131	137	142	147	152	157	162
18	113	118	123	128	132	138	143	148	153	158	163
19	114	119	124	129	133	139	144	149	154	160	165
20	115	120	125	130	134	140	145	150	155	160	165
21	116	121	126	131	135	140	146	151	156	161	166
Mature bulls											
24	118	123	128	133	137	142	147	152	157	163	168
30	120	125	130	135	139	145	150	155	160	165	170
36	122	127	132	137	141	146	151	156	161	166	171
48	123	128	133	137	142	147	152	157	162	167	172

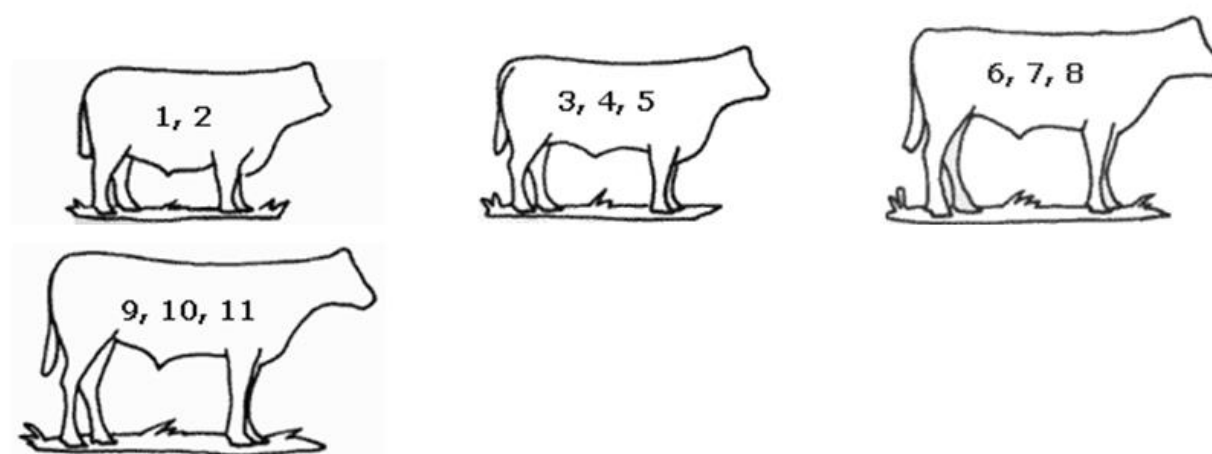


Figure 17. Maturity type and body/frame type scores

7. Health and Vitality:

Healthy animals have a better chance of achieving optimal weight gain. Select cattle that are free from any visible signs of disease, parasites, or injury. Look for animals with bright eyes, clean coats, alertness, and good body condition.

8. Feed Efficiency:

Consider the feed conversion ratio (FCR) of the cattle, which is the amount of feed required to produce a unit of weight gain. Animals with better feed efficiency can convert feed into weight gain more effectively, resulting in lower feed costs and improved profitability.

Feed efficiency= amount of feed consumed/body weight gain

9. Temperament:

Animals with calm and docile temperaments are generally easier to handle and manage which can reduce stress and improve overall performance during the fattening period. Aggressive or highly stressed animals may have reduced feed intake and lower weight gain.

Self-check questions -3	Written Test
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1. What should be the appropriate age range of cattle suitable for fattening?
2. Which frame score describes animals with very late maturity, extreme frame, very large mature size and difficult to fatten

Activity 1**A. Resources required**

- Measuring tape
- Record sheet

B. Procedures

- Visit the local cattle markets/farms
- Select at least five male cattle with different frame size
- Estimate their age by checking their teeth (dentition)
- Measure the animals hip height (cm)
- Calculate the frame score
- Rank the selected animals from the best to the least animal for fattening purpose

2.2. Length of Fattening Period and Profitability

1.2.1. Length of fattening period

The length of the fattening period and its profitability can vary depending on several factors, including the type of cattle, the desired market specifications, feed availability and cost, and management practices. Here are some general considerations:

Livestock Type: Different types of livestock, such as cattle, sheep, or goats, have different growth rates and fattening requirements. Cattle generally have longer fattening periods compared to sheep or goats due to their larger size and slower growth rates.

Market Specifications: The desired market specifications, such as carcass weight, fat cover, and meat quality, can influence the length of the fattening period. For example, if the market requires animals to reach a specific weight or fat cover, the fattening period may need to be extended to meet those requirements.

Feed Availability and Cost: The availability and cost of feed resources play a significant role in determining the length of the fattening period. If high-quality feed is readily available and affordable, animals may achieve desired weights and finish more quickly. Conversely, if feed resources are limited or expensive, the fattening period may need to be extended to allow for slower weight gain.

Feed Conversion Efficiency: The feed conversion efficiency of the animals being fattened also impacts the length of the fattening period. Animals with better feed conversion ratios (lower FCR) can convert feed into weight gain more efficiently, potentially shortening the fattening period.

Management Practices: Effective management practices, such as proper nutrition, health care, and handling, can help optimize weight gain and shorten the fattening period. Consistent monitoring, timely adjustments to feed rations, and addressing any health issues promptly can contribute to improved profitability.

1.2.2. Factors affecting profitability of cattle fattening

Profitability in fattening cattle is determined by the balance between the cost of inputs (feed, labor, healthcare, etc.) and the revenue generated from selling the fattened animals. Factors that influence profitability include:

Cost of Feed: Feed is typically the most significant cost in cattle fattening. The availability and cost of feed resources can impact profitability. Efficient utilization of feed and sourcing cost-effective feed options can help improve profitability.

Purchase Price: The cost of acquiring the cattle for fattening also affects profitability. Purchasing animals at a favorable price relative to their potential for weight gain and market value is important.

Market Prices: The prices at which the fattened cattle are sold in the market directly impact profitability. Market conditions and demand for cattle can fluctuate, affecting sale prices.

Fattening Efficiency: The efficiency of the fattening process, including growth rates and feed conversion efficiency, affects overall profitability. Animals that gain weight quickly and convert feed efficiently can reduce the cost per unit of weight gain.

Management Costs: Proper management practices, including healthcare, labor, and other inputs, can impact profitability. Efficient management practices that minimize costs without compromising animal welfare and performance are crucial.

It's important to conduct a comprehensive economic analysis, considering all costs and potential revenues, to assess the profitability of a specific fattening operation. Local market conditions, input costs, and management practices will play a significant role in determining the overall profitability of cattle fattening.

Calculating the profitability of beef cattle fattening involves considering various factors related to costs and revenues. Here are the key steps to calculate the profitability:

Determine the Initial Investment: Calculate the total cost of acquiring the feeder cattle, including the purchase price, transportation, and any additional expenses related to their acquisition.

Estimate Feed Costs: Determine the cost of feed required for the fattening period. Consider the type and quantity of feed, as well as its cost per unit. Keep in mind that feed costs can vary depending on factors such as the feed type, market prices, and the duration of the fattening period.

Account for Other Variable Costs: Consider other variable costs involved in cattle fattening, such as labor, veterinary care, medications, bedding, and miscellaneous expenses. Estimate these costs based on your specific circumstances and local market conditions.

Calculate Fixed Costs: Include fixed costs such as land or facility rental, equipment depreciation, insurance, and interest payments if applicable. These costs remain relatively stable regardless of the number of cattle being fattened.

Estimate Revenue: Estimate the potential revenue from selling the finished cattle. Consider the expected selling price per unit of weight, market demand, and any additional premiums that may be obtained for specific quality characteristics.

Subtract Total Costs from Total Revenue: Subtract the total costs (including initial investment, feed costs, variable costs, and fixed costs) from the total revenue obtained from selling the finished cattle. The result will give you an estimate of the net profit or loss.

Analyze Profitability: Assess the profitability of the beef cattle fattening operation by comparing the net profit or loss with your investment and desired return on investment. Consider factors such as market conditions, production efficiency, and any potential risks or uncertainties.

Table 3. Fattening cost of a fattening farm

Items of expenditure	
Variable cost	
• Feed cost	
• Labor cost	
• Water cost	
• Veterinary cost	
• Miscellaneous cost (rope...)	
Total variable cost	
Fixed cost	
• Initial animal cost	
• Cow shed and equipment/rent	

Total fixed cost	
Total fattening cost (Fixed cost + Variable cost)	

Table 4. Table returns of fattening farm

Variable	
Average herd size per farm	
Average Selling price per cattle	
Total Income from selling of fattened cattle	
Total cost	
Gross return	
Net return per farm	
Net return per cattle	

Self-check question -4	Written Test
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1. List down the factors affecting the length of the fattening period.
2. What are the most important factors affecting profitability of cattle fattening business?

Practical activity-2	Cattle selection criteria
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A. Resources required

- Cattle at different body conditions

B. Procedures

- Visit the local cattle markets/farms
- Select at least five male cattle with different body condition score
- By looking at the animal from different angles evaluate their body condition scores
- Rank the selected animals from the best to the least animal for fattening purpose

Practical activity-3	Cattle selection criteria
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A. Resources required

- Local cattle fattening enterprise

B. Select feeder cattle for fattening based on frame score

- Visit the local cattle fattening enterprise
- Collect data on the total production cost of the farm (feed cost, purchase prices, management cost and other costs)
- Collect data on the total estimated selling price of cattle in the farm
- Estimate the net profit of the fattening enterprise

Unit Summary

This chapter focuses on the key factors that influence cattle selection for fattening, the optimal length of the fattening period, and the overall profitability of the fattening process. Cattle selection for fattening involves considering various factors such as genetic potential, health, conformation, frame size, and cost-effectiveness. Animals with favorable genetic traits for growth, feed efficiency, and carcass quality are preferred. Animals with desirable conformation and suitable frame size can achieve higher carcass yields.

Determining the length of the fattening period is essential for maximizing profitability. A balance must be struck between weight gain and costs. Longer periods can increase feed and maintenance costs, while shorter periods may limit weight gain and market value. Optimal timing is crucial to achieve maximum weight gain without excessive costs. Profitability in cattle fattening depends on various factors, including the initial investment, feed costs, variable costs (such as labor and veterinary care), fixed costs (such as land or facility rental and equipment depreciation), and revenue from selling the finished cattle. Monitoring and analyzing these factors regularly, considering market conditions and production efficiency, are important for making informed decisions and improving profitability.

In summary, selecting cattle with desirable traits, determining the appropriate length of the fattening period, and effectively managing costs and revenues are key factors for achieving profitability in cattle fattening operations.

Unit Review Questions

1. Which of the following is a key selection criterion for cattle fattening?
 - A. Feed efficiency
 - B. Reproductive performance
 - C. Wool quality
 - D. Milk production
2. Frame score in cattle refers to:
 - A. The size of the cattle's skeletal structure
 - B. The weight of the cattle at a certain age
 - C. The color pattern of the cattle's coat
 - D. The overall health and vigor of the cattle
3. Body condition score in cattle is a measure of:
 - A. The animal's weight in relation to its age
 - B. The animal's overall health and vitality
 - C. The animal's fat and muscle distribution
 - D. The animal's reproductive performance
4. The dentition of feeder cattle can be used to determine their age based on:
 - A. The number and type of teeth present
 - B. The weight of the cattle
 - C. The color of their fur
 - D. The breed of the cattle
5. What is the preferred body shapes for feeder cattle?
 - A. Rectangular
 - B. Wedge shaped
 - C. Circular
 - D. Curved

Answer key for self-check questions

Answer key for self-check questions

Self-check question 3

Number	Answers
1	2-2.5 years old
2	8-11

Self-check question 4

Number	Answers
1	Cattle type, market specification, feed availability, feed conversion efficiency and management practices.
2	Cost of feed, purchase price, market price, fattening efficiency and management cost.

UNIT 3

Cattle Fattening Practice

Learning outcomes

At the end of this unit, the students will be able to

- Identify fattening systems
- Feed cattle for fattening
- Monitor growth
- Care the health of cattle fattening
- Keep record

Key Terms

- Feedlots
- Weighing
- Feeds
- Growth

Unit Introduction

What is cattle fattening and its objective?

Cattle fattening refers to the practice of feeding cattle with the goal of increasing their weight and improving their meat quality for eventual slaughter. The process typically involves providing animals with a balanced diet that meets their nutritional requirements and optimizing their growth rate to achieve maximum weight gain. Cattle fattening can be carried out in various settings, including feedlots, intensive farming systems, or pasture-based systems. In feedlots, animals are confined to a specific area and fed a controlled diet to promote rapid weight gain. Intensive farming systems involve raising animals in enclosed spaces with controlled environmental conditions. Pasture-based systems allow animals to graze and forage in open pastures while also receiving supplementary feed.

The primary objective of cattle fattening is to increase animals' body weight and convert their feed into muscle mass. This is achieved through a combination of proper nutrition, genetics, and management practices. Feed formulations are designed to meet the animals' energy, protein, vitamin, and mineral requirements, often using a combination of grains, forages, protein sources, and supplements. Cattle fattening requires careful monitoring of animal health and welfare. Regular veterinary care, vaccinations, and disease prevention measures are essential to maintain the animals' well-being.

3.1. Fattening Systems

Cattle fattening systems refer to different approaches or methods used to raise and feed animals with the goal of promoting weight gain and achieving optimal market weight. These systems vary in terms of the management practices, feeding strategies and environments provided to the animals. In Ethiopia, cattle fattening systems are an important component of the livestock sector. Common beef cattle fattening systems practiced in Ethiopia are:

A. Agro-pastoral system

This system combines crop production with livestock rearing. Cattle graze on crop residues and aftermaths after harvest, utilizing the by-products of crop farming. Farmers in Ethiopia often practice mixed farming, where cattle are allowed to graze on communal lands or open grazing areas while also benefiting from crop residues.

In Ethiopia, the agro-pastoral system and cattle fattening are significant components of the agricultural sector. Key considerations for agro-pastoral cattle fattening system in Ethiopia:

- **Breeds:** Local cattle breeds such as Boran, Arsi, and Fogera are commonly used for fattening. These breeds are well-adapted to the local environment and have good growth potential.
- **Feeding:** Cattle are usually grazed on communal or privately-owned pasturelands. During the dry season or when pasture availability is limited, supplemental feeding with crop residues (such as wheat or barley straw) and agro-industrial by-products (like oilseed cakes or brewery waste) is common. The use of concentrate feeds may be limited due to cost constraints.
- **Housing and facilities:** Adequate housing and facilities are essential for the well-being of the cattle. Shelter should protect them from extreme weather conditions and provide enough space for movement. Facilities for feed storage, water supply, and waste management should be available.
- **Veterinary services:** Access to veterinary services and animal healthcare can vary in different regions of Ethiopia. Local veterinary professionals, community animal health workers, or government extension workers may provide basic veterinary care, vaccinations, and guidance on disease prevention and treatment.
- **Market opportunities:** Ethiopia has a growing demand for meat, driven by population growth and urbanization. The market for fattened cattle exists both locally and internationally. Farmers can sell their cattle at local markets, regional livestock markets, or through direct sales to butchers, processors, or exporters.
- **Government support:** The Ethiopian government recognizes the importance of the livestock sector, including cattle fattening, and has implemented various policies and programs to support farmers. These initiatives aim to improve animal health services, promote access to credit, enhance market linkages, and provide training and extension services.



Figure 18. Integrated crop-cattle systems

B. Semi-intensive system

The semi-intensive system of cattle fattening in Ethiopia is a modified approach that lies between extensive (traditional) and intensive systems. It involves providing a higher level of management and inputs compared to extensive systems while still utilizing grazing and available resources to a certain extent. Key considerations for semi-intensive cattle fattening system in Ethiopia:

- Breeds: Indigenous cattle breeds, such as Boran, Arsi, and Fogera, are commonly used in the semi-intensive system.
- Feeding: While grazing is still practiced, supplementary feeding is an essential component of the semi-intensive system. Farmers provide additional feed to enhance weight gain and meet the nutritional requirements of the cattle. This includes crop residues, agro-industrial by-products, and concentrate feeds such as grains and oilseed cakes. Feed availability and affordability can vary based on the region and resources.
- Housing and infrastructure: In the semi-intensive system, cattle are provided with improved housing conditions compared to extensive systems. This may include simple structures or sheds that protect the animals from extreme weather conditions. Fenced grazing areas or paddocks are also established to manage grazing and prevent overgrazing.
- Health and veterinary care: Regular veterinary care and monitoring are essential in the semi-intensive system. Cattle may receive vaccinations, deworming, and treatment for diseases and parasites. Access

to veterinary services, including vaccinations and veterinary advice, may be facilitated through government programs or private veterinary service providers.

- **Management practices:** The semi-intensive system requires careful management to optimize cattle growth and health. This involves maintaining proper feeding schedules, monitoring weight gain, adjusting feed rations, and providing clean water and adequate shade. Regular observation of cattle behavior and health indicators is important to detect any issues early on.
- **Market opportunities:** The cattle fattened in the semi-intensive system can be sold in local markets, regional livestock markets, or through direct sales to processors and exporters. Farmers may also participate in collective marketing initiatives or cooperatives to access wider markets and secure better prices for their cattle.



Figure 19. Semi-intensive system

C. Smallholder ranching system

In the context of Ethiopia, the term "smallholder ranching system" refers to a farming system where small-scale farmers engage in livestock production on a smaller scale. It involves raising indigenous cattle breeds and, in some cases, small ruminants like sheep and goats. The farmers typically have limited land and resources but utilize communal grazing lands or privately owned pastures for grazing their livestock. Considerations for smallholder ranching in Ethiopia:

- **Land and grazing management:** Smallholder ranchers in Ethiopia utilize communal grazing lands, privately owned pastures, or a combination of both. The availability and management of grazing lands can vary by region and season. Farmers practice rotational grazing to ensure sustainable forage utilization and maintenance of pasture quality.
- **Livestock selection:** Indigenous cattle breeds such as Boran, Arsi, and Fogera are commonly raised in smallholder ranching systems in Ethiopia. These breeds are well-adapted to local environmental conditions, have good disease resistance, and provide various benefits such as meat, milk, and draft power.

- **Feeding and nutrition:** Smallholder ranchers rely on a combination of grazing and supplementary feeding to meet livestock nutritional needs. Grazing on communal lands or privately owned pastures allows access to natural forage. Supplementary feeding includes crop residues (e.g., wheat or barley straw), agro-industrial by-products, and locally available feed resources. Balancing the diet and optimizing feed resources are essential for livestock productivity.
- **Housing and infrastructure:** Housing structures in smallholder ranching systems in Ethiopia are often simple and built with locally available materials, providing shelter and protection from extreme weather conditions. Fencing is used to manage grazing areas and separate livestock from crop fields or sensitive areas.
- **Health and veterinary care:** Smallholder ranchers prioritize livestock health and seek veterinary care for vaccinations, disease prevention, and treatment. Access to veterinary services can vary depending on the region and proximity to veterinary clinics or extension services. Government programs and non-governmental organizations often play a role in providing veterinary support and training to smallholder ranchers.
- **Market access:** Smallholder ranchers in Ethiopia primarily focus on local or regional markets to sell their livestock and livestock products. They may engage in direct sales to consumers, local markets, or participate in collective marketing initiatives such as cooperatives or farmer groups. Developing market linkages and value chain integration can improve market access and income generation for smallholder ranchers.



Figure 20. Ranching system

D. Zero-Grazing System

In areas with limited grazing land or unfavorable climatic conditions, zero-grazing systems are practiced. Cattle are housed in confinement and fed a balanced diet consisting of cut-and-carry forages, crop residues, and concentrates. Considerations for zero-grazing cattle fattening system in Ethiopia:

- **Housing and confinement:** Cattle in the zero-grazing cattle fattening system are kept in stalls or pens, which provide a controlled environment for feeding and management. The housing structures are designed to ensure proper ventilation, cleanliness, and space for the cattle. The size and design of the housing depend on the number of animals being fattened.
- **Feed management:** The zero-grazing cattle fattening system relies on a well-balanced and carefully managed diet to maximize weight gain. Farmers focus on providing a combination of forage, concentrates, and supplementary feed to meet the nutritional requirements of the cattle. Forage crops such as Napier grass, maize silage, or sorghum are often cultivated or purchased to ensure a consistent feed supply.
- **Feed preparation and feeding:** In the zero-grazing system, farmers harvest and prepare forage crops or feed ingredients, which are then cut or chopped into smaller pieces for easy consumption. The feed is delivered to the cattle in their confined area, and feeding is typically done multiple times a day to ensure regular intake and optimal feed utilization.
- **Health and veterinary Care:** Proper animal health management and veterinary care are essential in the zero-grazing cattle fattening system. Farmers should provide regular vaccinations, deworming, and preventive treatments to maintain the health and welfare of the cattle. Access to veterinary services and advice is important for disease prevention and early intervention.
- **Manure management:** Effective management of animal waste is crucial in the zero-grazing cattle fattening system to prevent environmental pollution and utilize the nutrients. Farmers can collect and store the manure for use as organic fertilizer in crop production, promoting nutrient recycling and soil fertility improvement.
- **Marketing and sales:** Once the cattle reach the desired weight and condition for sale, farmers can market them to local buyers or through collective marketing initiatives. Access to slaughterhouses, meat processing facilities, and reliable market channels is important for the successful sale of fattened cattle.



Figure 21. Zero-grazing system

E. Feedlots

Feedlot fattening systems, also known as intensive or concentrated animal feeding operations, involve raising livestock, typically cattle, in confined areas called feedlots: Animals are confined in enclosed areas and fed a high-energy diet consisting of grains, protein supplements, and sometimes byproducts. Feedlots are often used for fattening cattle, as they can efficiently convert feed into weight gain. Features of feedlot fattening systems

- **Confinement:** Animals in feedlots are confined to relatively small areas or pens, which allows for efficient management and control of feeding, health monitoring, and waste management. The pens are designed to accommodate a specific number of animals based on their size and weight.
- **High stocking density:** Feedlots have high stocking densities, with a large number of animals housed in a relatively small area. This allows for efficient use of space and facilitates economies of scale in terms of feed, labor, and infrastructure.
- **Controlled nutrition:** Animals in feedlots are fed a carefully formulated, high-energy diet to promote rapid weight gain. The diet typically consists of a combination of grains, protein supplements, roughage, and other feed additives. The feed is often processed and mixed to ensure consistent nutrition and maximize feed efficiency.
- **Growth promotion:** Feedlot systems aim to promote rapid weight gain in animals through intensive feeding and management practices. The goal is to bring animals to market weight quickly and efficiently, maximizing profitability.
- **Health monitoring:** Due to the high stocking density and potential stressors associated with confinement, health monitoring is crucial in feedlot systems. Animals are closely observed for signs of illness, and any health issues are addressed promptly to minimize the risk of disease spread within the feedlot.
- **Waste management:** Feedlots generate a significant amount of animal waste, including manure and wastewater. Proper waste management practices are implemented to minimize environmental impacts and maintain hygiene. This may involve collecting and storing manure for later use as fertilizer or implementing waste treatment systems to minimize pollution.
- **Animal welfare Considerations:** Animal welfare is an important consideration in feedlot systems. Adequate provision of clean water, proper ventilation, comfortable resting areas, and careful handling practices are essential to ensure the well-being of animals in the feedlot environment.
- **Feed efficiency:** Feedlot systems are designed to optimize feed conversion efficiency, converting feed into weight gain as efficiently as possible. The controlled environment, specialized diet, and genetic selection of animals for fast growth contribute to high feed efficiency in feedlots.

The calculation of feed efficiency in feedlot systems is typically done using the feed conversion ratio (FCR) or the gain-to-feed ratio (G: F). These formulas compare the amount of feed consumed by animals to the weight gain achieved. Here are the basic formulas for calculating feed efficiency:

1. Feed Conversion Ratio (FCR):

FCR = Total feed consumed (in weight) / Total weight gain. For example, if the total amount of feed consumed by animals in a feedlot is 1,000 kilograms and the total weight gain achieved is 200 kilograms, the FCR would be:

$$\text{FCR} = 1,000 \text{ kg} / 200 \text{ kg} = 5$$

This means that it took 5 kilograms of feed to produce 1 kilogram of weight gain.

2. Gain-to-Feed Ratio (G: F):

$$\text{G: F} = \text{Total weight gain} / \text{Total feed consumed (in weight)}$$

Using the same example, the G: F ratio would be:

$$\text{G: F} = 200 \text{ kg} / 1,000 \text{ kg} = 0.2$$

This means that for every kilogram of feed consumed, there was 0.2 kilograms of weight gain.

Both FCR and G: F are used to assess feed efficiency in feedlot systems. Lower values of FCR or higher values of G: F indicate better feed efficiency, as it means less feed is required to achieve a certain amount of weight gain.

Cattle in feedlots



Figure 22. Beef cattle fattening in feedlots

Self-check questions-5

Written test

Match the production systems under column A with their feature under column B

	<u>A</u>	Answers	<u>B</u>
1	Pasture-Based Systems		A. Animals are confined to relatively small areas or pens
2	Agro-industrial byproduct feeding system		B. Utilizing agro-industrial byproducts as feed
3	Feedlots		C. Prioritize animal welfare by allowing animals to exhibit natural behaviors
			D. Fattening cattle




3.2. Feeding Fattening Cattle





Feeding cattle for fattening involves providing a specific diet and management practices to promote weight gain and the deposition of fat in the animals, typically in preparation for meat production.

3.2.1. Feed sources

Cattle fattening requires a reliable and diverse range of feed sources to meet the nutritional needs of the animals. The choice of feed sources depends on factors such as the type of cattle, availability, cost, and nutritional composition. Common feed sources used in cattle fattening are listed below table:

Table 5. Common feed sources cattle fattening

Feed sources	Description	Picture
Forage	Pasture grasses, legumes (e.g., alfalfa, clover), and browse plants	
Silage	Fermented feed made from chopped, high-moisture crops (e.g., corn, sorghum, grasses)	
Hay	Dried forage used when fresh forage is limited or during dry period	

Feed sources	Description	Picture
Industrial by-products	Wheat bran, rice bran, cottonseed meal, nougcake, molasses and etc.	 
Minerals and vitamins premix	Essential micronutrients provided through supplements or premixed formulations	
Feed additives	Probiotics, prebiotics, enzymes, growth promoters, etc., to enhance feed efficiency and animal health	

Practical activity-1	Identify feed sources for cattle fattening
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A. Resources required

- Record sheet

B. Procedure

1. Prepare record sheet
2. Contact your local agricultural office or government agricultural department to obtain information on the crops grown in that area, potential agro industrial by-products and crop residues available as feed sources.
3. Reach out to local feed suppliers and inquire about the feed ingredients they offer such as minerals and vitamins premix, feed additives and industrial by-products. Ask for information on the nutritional composition, availability, and prices of different feed sources they provide.
4. Contact your local agricultural extension services or agricultural universities. Seek guidance from agricultural extension officers who can provide valuable insights on available feed sources and their suitability for dairy cattle.
5. Compile the data obtained from the agricultural office, feed suppliers, and agricultural extension services.
6. Decide to purchase and collect the available feeds

3.2.2. Providing feed

Feeding cattle for fattening refers to the practice of providing a specific diet to animals with the goal of promoting weight gain and increasing their body condition for eventual sale or slaughter. This process is commonly employed in cattle production systems to enhance the profitability of the enterprise. Common consideration in feeding cattle for fattening:

A. Nutrient composition of feeds

Nutrient composition refers to the quantitative measurement and description of the nutrients present in various types of feed ingredients used in animal nutrition. Nutrients are essential substances that provide energy, support growth, and maintain overall health in animals. The nutrient composition of feeds includes information on the levels of key nutrients such as protein, fiber, carbohydrates, fats, vitamins, minerals, and energy content. These nutrients play vital roles in the animal's metabolism, growth, reproduction, and overall performance.

B. Nutritional requirements of the fattening cattle

Cattle have specific nutritional needs based on their species, age, and purpose. The diet should be formulated to meet these requirements, ensuring an adequate supply of energy, protein, vitamins, minerals, and water. The nutritional requirements of cattle are listed in the following table:

Table 6. Nutritional requirements of the fattening cattle

Nutritional requirements	Cattle
Energy (Total digestible nutrients)	65-75% of diet
Protein (crude)	10-14% of diet
Fiber (roughage/forage)	Minimum 10% of diet
Calcium	0.3-0.5% of diet
Phosphorus	0.2-0.4% of diet
Minerals and vitamins premix	0.1-0.3% of diet

C. Determining the roughage-to-concentrate ratio

Determining the roughage-to-concentrate ratio for fattening cattle involves establishing the appropriate balance between roughage (fiber-rich feeds) and concentrates (energy-dense feeds) in the animals' diet. The specific ratio depends on several factors, including the type of cattle, their nutritional requirements, the desired rate of weight gain, and available feed resources. Roughage-to-concentrate ratio for cattle is 60:40 to 70:30

D. Calculating the total feed daily intake

For beef cattle, the general guideline is that they consume 2% to 3% of their body weight as dry matter per day. Let's use the midpoint of this range, assuming the steer consumes 2.5% of its body weight as dry matter per day and the body weight the bull is 500kg

Total Feed Intake = Body Weight x Dry Matter Intake Percentage

Total Feed Intake = 500 kg x 0.025

Total Feed Intake = **12.5 kg** of dry matter feed per day

So, for a 500 kg beef steer, the total feed daily intake would be approximately 12.5 kg of dry matter feed.

E. Formulating ration and providing for the animals

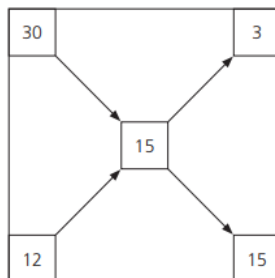
Ration formulation is the process of developing a balanced diet for animals by determining the appropriate proportions of various feed ingredients to meet their specific nutritional requirements. It involves considering the nutrient composition of available feed ingredients, cattle nutrient requirements and formulating a diet that provides the necessary amounts of energy, protein, fiber, vitamins, minerals, and other essential nutrients. This involves calculating the appropriate proportions of each ingredient to achieve the desired nutrient levels. The goal is to provide adequate energy, protein, and other nutrients while minimizing nutrient imbalances or deficiencies.

There are several ration formulation methods that can be used for cattle fattening. The choice of method depends on factors such as the availability of feed ingredients, nutritional requirements of the animals, and the desired growth rate. Commonly used ration formulation methods:

- Pearson square method: This is a simple method that involves using a square diagram to balance the proportions of two feed ingredients. It is suitable when only two ingredients need to be mixed to meet the animal's nutrient requirements.

Example: A cattle fattening farmer wants to formulate a concentrate supplement that provides 15% crude protein (CP). The grain we have available is lupins at 30% protein and barley at 12% protein.

Step 1. Draw a square and insert the desired crude protein (15%) in the middle of the square.



Step 2. Place the two grains and their respective crude protein contents on the left hand corners of the square.

Step 3. Calculate the difference between the middle value and the value on the bottom and top left hand corners of the square and place the result diagonally opposite. These values represent the portion of each grain required to produce a grain mix with a CP level of 15%. $30 - 15 = 15$ (Value in the bottom right corner of the square) $12 - 15 = 3$ (Value in the top right corner of the square)

Step 4. Calculate the percentage of each grain. Add the two portion figures to give the total and calculate each feed as a percentage. $3 + 15 = 18$

Lupins

(Difference of middle value and barley value) $3 \div 18$ (total of the two differences) $0.167 \times 100 =$ (% of lupins) 16.7 %

Barley

(Difference of middle value and lupin value) $15 \div 18$ (total of the two differences) $0.833 \times 100 =$ (% of barley) 83.3

- Trial and error method: This method involves formulating rations through a trial and error process. Start with an initial formulation, feed it to the animals, monitor their performance, and make adjustments as needed. This method allows for flexibility and fine-tuning based on observed results.
- Algebraic methods: Algebraic methods can be used in ration formulation to mathematically represent the relationships between nutrient requirements and feed ingredient composition. Assign variables to represent the quantities or proportions of feed ingredients in the ration. Commonly used variables are 'x', 'y', 'z', and so on. For example, 'x' could represent the proportion of Feed Ingredient A; 'y' could

represent the proportion of Feed Ingredient B, and so on. The specific variables used depend on the number of feed ingredients and their proportions in the ration.

- Computer software/spreadsheet method: Various computer software programs and spreadsheets are available that can help with ration formulation. These tools consider the nutrient requirements of the animals, availability of feed ingredients, and cost constraints to optimize the formulation. They provide precise calculations and can handle complex formulations.

F. Gradually transitioning animals to a grain-based diet

It is essential to avoid digestive upset and ensure a smooth transition. General guideline on how to gradually introduce grain diets to animals is:

- Start with forage: Animals should have a foundation of forage in their diet, such as pasture, hay, or silage.
- Introduce small amounts of grain: Begin by offering a small portion of grain to the animals alongside their regular forage. Start with a small quantity, such as 0.5-1% of their body weight per day.
- Monitor and assess: Pay close attention to the animals' response to the grain. Observe their appetite, stool consistency, and overall health. Gradually increase the grain amount over time while monitoring their well-being.
- Over a period of 7-10 days, gradually increase the proportion of grain in their diet. Increase the amount by 10-20% every 2-3 days until the desired grain portion is reached.
- Provide clean water: Make sure clean and fresh water is readily available to animals at all times. Proper hydration is crucial for digestion and overall health.

Practical activity-2	Feed cattle in feedlots
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A. Resources required

- Grains: Such as corn, barley, wheat, or sorghum
- Protein sources: Including soybean meal, canola meal, cottonseed meal, or distillers' grains, which provide essential amino acids.
- Forages: Such as hay or silage, which add fiber to the diet
- Supplements: Including mineral mixes, vitamins, or additives to address specific nutritional requirements.
- Weighing scales: To measure feed quantities during mixing or delivery.

- Water and feed troughs: Used to provide constant supply water and feeds.
- Record-keeping format: To record and track feed inventories, feed formulas, feed deliveries, and feed consumption.

B. Procedures

1. In a feedlot, cattle are typically brought in at a young age and raised to reach market weight within a relatively short period
2. Consult with an animal nutritionist to determine the specific nutritional needs of the livestock based on their species, age, weight, and production goals. Consider factors such as protein, energy, fiber, vitamins, and minerals required for optimal growth and health.
3. Work with an animal nutritionist to formulate a balanced feed ration that meets the nutritional requirements of the cattle. Consider the availability and cost of feed ingredients while ensuring that the ration provides adequate nutrition. Take into account the specific feeding stages, such as starting, growing, or finishing, and adjust the ration accordingly.
4. Use appropriate equipment, such as feed mixers or blenders, to thoroughly mix the ingredients and create a uniform feed mixture.
5. Transfer the mixed feed to feeding feed trough
6. Determine the feeding schedule, considering the number of daily feedings and the quantity of feed to be provided at each feeding.
7. Observe the cattle's behavior, such as feed intake, weight gain, and overall health, to assess the adequacy of the diet.
8. Ensure that clean and fresh water is available to the cattle at all times. Provide adequate water sources, such as troughs or automatic watering systems, to meet the cattle's hydration needs.
9. Periodically evaluate the cattle's performance, including weight gain, feed conversion, and overall health.
10. Maintain accurate records of feed inventories, feed formulas, feed deliveries, and feed consumption by the cattle. Record any changes made to the feed ration, feeding schedule, or other relevant factors for future reference.

Self-check questions-6	Written test
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Give correct answers for the following questions

1. Write the major feed sources for cattle fattening?

2. Write at least four considerations in cattle feedings?

3.2.3. Providing water for fattening cattle

Water is vital for livestock survival, but restricting water intake also immediately reduces feed intake and so cattle performance and production. The water requirements of livestock are met by water consumed voluntarily (i.e. water that is drunk), water consumed in feed, water retained within the body due to oxidation reactions involved in metabolism.

Daily live weight gain for beef cattle on a high dry matter finishing diet can suffer immensely where water requirements are not fulfilled. Water requirements for finishing cattle increases as live weight gain increases too. Cattle can drink up to 15 liters of water/day per 100 kg's of live weight. However, this can increase significantly in warm weather conditions.

3.3. Growth Monitoring

Growth monitoring plays a crucial role in cattle fattening as it helps farmers assess the progress and development of animals throughout the fattening period. By regularly monitoring growth, farmers can make informed decisions regarding nutrition, management practices, and overall animal health. It is important to weigh the animals at the beginning of the fattening period to establish a baseline weight. This initial measurement helps in setting growth targets and evaluating the effectiveness of the fattening program. Animals should be weighed at regular intervals throughout the fattening period to track their weight gain and growth rate. The frequency of weighing may vary depending on factors such as the duration of the fattening period and the livestock species. Weekly or monthly weighing is common. Common methods and considerations for growth monitoring in cattle:

A. Weighing the cattle with weighing scale

A weighing scale is a device specifically designed to measure the weight of objects or living beings. In the context of cattle, weighing scales are used to accurately determine the weight of individual animals or groups. There are various types of cattle weighing scales available, including weighing chutes for weighing cattle. Weighing chutes are designed for weighing cattle, particularly cattle. They are narrow passageways or enclosures with gates at both ends. Cattle are directed into the weighing chute, and once inside, the gates are closed to prevent the animal from moving. The animal's weight is then measured on a scale integrated into the chute. Weighing chutes are commonly used in farms, feedlots, and cattle markets to accurately

determine the weight of cattle for various purposes, such as monitoring growth, assessing health, or determining market value.



Figure 23. Weighing chutes

A. Resources required

Practical activities-3	Measure weight by weighing scale
------------------------	----------------------------------

- Record sheet
- Restraining materials like crush
- Weighing Scale

B. Procedure

1. Choose a weighing scale that is suitable for the size and weight capacity of your cattle. Consider factors such as the species of animals, their average weight, and the frequency of weighing.
2. Clear the area where the weighing scale will be placed. Ensure that it is level and free from any obstacles that could interfere with the weighing process.
3. Some weighing scales may require calibration before use. Follow the manufacturer's instructions to ensure accurate measurements.
4. Use animal handling techniques to guide the animal onto the scale platform, load bars, or into a weighing chute.
5. Once the animal is positioned on the scale, ensure that it is safely and securely held in place.
6. Take the weight measurement

7. Note down the weight measurement for each animal, either manually or using an electronic recording system.
8. Once the weight measurement is complete, safely release the animal from the weighing area. Ensure that the animal exits without any risk of injury.
9. After weighing, clean and maintain the weighing scale according to the manufacturer's instructions. Regular maintenance helps ensure accurate measurements and prolongs the lifespan of the equipment.

B. Estimate the weight based on body length and heart girth circumference

To estimate the weight of an animal based on its body length and heart girth circumference, you can use specific formulas or tables that have been developed for different livestock species. These formulas take into account the relationship between body length, heart girth circumference, and weight.

To calculate the estimated weight of an animal based on body length and heart girth circumference, you will need to use the appropriate formula or table specific to the species of animal you are working with. Here are the formulas for estimating weight based on heart girth and body length:

$$\text{Weight (in kilograms)} = (\text{Heart Girth in centimeters} * \text{Heart Girth in centimeters} * \text{Body Length in centimeters}) / 300$$

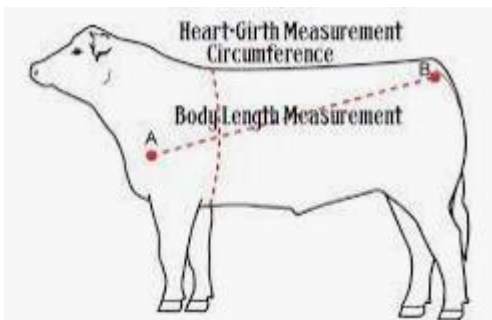


Figure 24. How to measure body length and circumference



Figure 25. Tape measure

A. Resources required

Practical activities-4	Measure weight based body length and heart girth
------------------------	--

- Heart girth and body length measuring tape
- Pen and paper for recording measurements
- Reference materials or guidance for accurate weight estimation

B. Procedure

1. Prepare the animal: Ensure the animal is calm and in a secure location.
2. Measure the heart girth circumference: Place the heart girth measuring tape around the animal's chest at the widest part, just behind the shoulder blades. Make sure the tape is snug but not too tight. Read and record the heart girth measurement in centimeters or inches.
3. Measure the body length: Use the body length measuring device to measure the length of the animal. Start at the point of the shoulder and measure up to the base of the tail. Record the body length measurement in centimeters or inches.
4. Calculate the estimated weight: Use the formulas for estimating weight based on heart girth and body length

Note: Both tape measures and heart girth measurements provide a means to estimate the weight of cattle when a weighing scale is not available or practical.

C. Growth rate calculation

Calculating the average daily weight gain (ADG) or the growth rate is essential for evaluating the performance of the animals. ADG is determined by dividing the total weight gain by the number of days between weightings. The formula to calculate the average daily weight gain (ADG) in cattle fattening is as follows:

$$\text{ADG} = (\text{Final weight} - \text{Initial weight}) / \text{Number of days}$$

Where: ADG is the average daily weight gain.

Final weight is the weight of the animal at the end of the specified period.

Initial weight is the weight of the animal at the beginning of the specified period.

Number of days is the duration between the initial and final weighing.

Suppose you have a bull with an initial weight of 500 kilograms. After a period of 120 days, a bull has a final weight of 700 kilograms.

$$\text{ADG} = (700 \text{ kg} - 500 \text{ kg}) / 120 \text{ days}$$

$$\text{ADG} = 200 \text{ kg} / 120 \text{ days}$$

$$\text{ADG} \approx 1.67 \text{ kg/day}$$

D. Comparison to target weight and record

Farmers should have a target weight or desired market weight for their animals. Regularly comparing the current weight of the animals to the target weight helps monitor their progress and adjust feeding and management practices accordingly. Accurate and detailed records of weights and growth rates should be maintained. This information helps identify trends, compare individual animals or groups, and assess the overall progress of the fattening operation.

Self-check questions -7	Written test
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Write correct answers for the following questions

1. Write the formula used to calculate daily weight gain.
2. Write the formula used to estimate the weight of cattle based on body length and heart girth circumference

3.4. Fattening Cattle Health Care

Cattle fattening health care is a critical aspect of ensuring the well-being and optimal growth of animals during the fattening process. It encompasses practices such as deworming, vaccination, and inspecting newly purchased animals. Deworming helps control internal parasites, promoting better nutrient absorption and overall health. Vaccination programs protect animals from diseases, reducing the risk of outbreaks and ensuring their well-being. Thorough inspections of newly purchased animals allow for early identification of health issues and prevent the spread of diseases within the herd. By implementing these practices, cattle farmers can maintain the health, prevent diseases, and maximize the success of their cattle fattening operations.

3.4.1. Inspect purchased cattle

Inspect purchased cattle means conducting a thorough examination of the animals you have acquired to assess their overall health, condition, and suitability for your specific needs. This inspection is important to ensure that you are obtaining healthy and suitable animals for your farming operation. Some key points to focus on:

Health assessment: Observe the animals for any signs of illness or disease. Look for symptoms such as coughing, nasal discharge, diarrhea, lameness, abnormal behavior, or poor appetite. If you notice any abnormalities, consult with a veterinarian for further evaluation and treatment.

Arrange for a comprehensive veterinary examination of the animals you have purchased. A veterinarian will conduct a thorough physical examination, including checking vital signs, listening to the heart and lungs, examining the eyes, mouth, and teeth, and palpating the body for any abnormalities or signs of pain. They may also perform diagnostic tests, such as blood work or fecal examinations, to check for any underlying health conditions or diseases.

Structural soundness: Assess the structural soundness of the animals. Pay attention to their posture, gait, and overall conformation. Look for any signs of lameness, joint abnormalities, or structural defects that may affect their movement or long-term health.

Behavior and temperament: Observe the animals' behavior and temperament. Healthy animals should exhibit normal behavior, such as being alert, curious, and responsive to their surroundings. Docile and manageable temperaments are generally more desirable, particularly for ease of handling and management.

3.4.2. De-worming and vaccination cattle

De-worming and vaccination are important components of a comprehensive health management program for fattening cattle. These practices help prevent and control the spread of diseases, improve animal welfare, and promote optimal growth and productivity. Here's an overview of de-worming and vaccination in the context of fattening cattle:

De-worming

It refers to the administration of medications or treatments to eliminate or control internal parasites, commonly referred to as worms, in animals.

- **Importance:** Internal parasites, such as worms, can negatively impact the health, feed efficiency, and growth of cattle. They can cause weight loss, anemia, decreased appetite, and overall poor performance. De-worming helps control and eliminate internal parasites, ensuring that the animals can efficiently utilize the nutrients from their feed.
- **Timing:** De-worming protocols vary depending on the specific parasites present in the region and the type of cattle. Generally, de-worming is done at regular intervals, typically every few months or as

advised by a veterinarian. The timing may also depend on the age, weight, and health status of the animals.

Vaccination

Vaccination is a preventive measure that involves the administration of vaccines to stimulate an animal's immune system and provide protection against specific infectious diseases.

- **Importance:** Vaccination helps protect cattle from infectious diseases, reducing the risk of illness and mortality. Vaccines stimulate the animal's immune system to produce protective antibodies against specific diseases. Vaccination is particularly crucial in intensive fattening systems, where animals are often housed in close proximity, making disease transmission more likely.
- **Vaccine selection:** The selection of vaccines depends on the prevalent diseases in the region and the specific requirements of the cattle. Common vaccines for fattening cattle may include those for respiratory diseases (e.g., infectious bovine rhinotracheitis, bovine viral diarrhea, and bovine respiratory syncytial virus), clostridial diseases (e.g., blackleg), and reproductive diseases (e.g., leptospirosis).
- **Timing and administration:** Vaccination schedules vary depending on the age, species, and specific vaccine requirements. Some vaccines require multiple doses or booster shots to establish long-term immunity. It is essential to follow the recommended vaccination protocols provided by the vaccine manufacturer or consult with a veterinarian for guidance.

Self-check question -8	Written test
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Match the description under column A with their correct meaning under column B

	<u>A</u>	Answers	<u>B</u>
1	Administration of medications or treatments to eliminate or control internal parasites		A. De-worming
2	A preventive measure that involves the administration of vaccines		B. Vaccination schedules
3	Timing and Administration		C. Vaccination

4	Look for symptoms such as coughing, nasal discharge, diarrhea, lameness		D. Behavior and Temperament
5	Posture, gait, and overall conformation		E. Structural Soundness
6	Being alert, curious, and responsive to their surroundings		F. Health Assessment
			D. feedlots

3.5. Record Keeping

Record keeping is crucial for cattle fattening as it allows farmers to track the progress, health, and performance of the animals. Common record-keeping system for cattle fattening:

Identification: Assign a unique identification number or tag to each animal. This helps in tracking individual animals throughout the fattening process.

Reproduction record: Records related to the breeding and reproductive history of cows, including breeding dates, pregnancy status, and calving records.

Health records: Keep track of vaccinations, deworming, and any other health treatments administered to the animals. Record the date, type of treatment, and dosage given. This helps in maintaining the health and preventing the spread of diseases within the herd.

Feeding and nutrition: Maintain a feeding record that includes the type and quantity of feed provided, feeding frequency, and any changes made in the feed composition. This record assists in monitoring the animals' nutritional intake and adjusting the feeding program as needed.

Weight and growth monitoring: Regularly weigh the animals and record their weights along with the corresponding dates. This allows for tracking growth rates and adjusting the feeding program accordingly. You can use the weighing scale or tape measure methods mentioned earlier to measure the weight or other body dimensions.

Feed conversion efficiency: Calculate and record the feed conversion ratio (FCR) for each animal or group. FCR is the amount of feed required to produce a unit of weight gain. This metric helps in evaluating the efficiency of the feeding program and identifying potential improvements.

Mortality and health Incidents: Record any mortality events, illnesses, injuries, or other health incidents that occur during the fattening period. Include details such as date, symptoms, treatment provided, and outcomes. This information aids in identifying and addressing health issues promptly.

Financial records: Keep a record of expenses related to feed, veterinary services, labor, medications, and other inputs. Also, maintain records of sales, including dates, prices, and buyers. This helps in monitoring profitability and making informed business decisions.

Observations and notes: Encourage the recording of observations and notes regarding animal behavior, changes in appetite, water consumption, or any other notable observations. These records can provide valuable insights into the animals' well-being and help in identifying potential issues.

Data analysis: Regularly review and analyze the recorded data to assess the performance of the animals, identify trends, and make informed decisions about feed management, health interventions, and overall management practices.

Self-check question-9	Written test
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Match the description under column A with their record types under column B

	<u>A</u>	Answers	<u>B</u>
1	Assign a unique identification number or tag to each animal		A. Materials record
2	Vaccinations, deworming record		B. Health Records
3	Type and quantity of feed record		C. Feeding and Nutrition
4	Income and expenses record		D. Financial Records
5	Breeding dates, pregnancy status, and calving records		E. Reproduction record
			F. Identification

Unit Summary

The choice of production system depends on factors such as available land, climate, market demands, and the specific goals of the operation. It's important to consider the nutritional requirements of the animals, the availability and quality of feed resources, and the level of management intensity required for each system. Feeding involves providing a balanced diet that meets the nutritional needs of the animals, combining roughage and concentrated feed. Growth monitoring includes regularly weighing the animals and assessing their body condition to track progress. Health management involves vaccinations, deworming, and maintaining a clean environment. Record-keeping is crucial for monitoring feed consumption, weight gain, health treatments, and financial information. By focusing on these aspects, you can optimize growth, animal health, and overall efficiency in your cattle fattening operation.

Unit review questions

1. Which cattle fattening system is associated with animals grazing on natural or cultivated pastures?
 - A. Agro-industrial byproduct feeding system
 - B. Feedlots
 - C. Pasture-based systems
 - D. None of the above
2. Which cattle fattening system aims to maximize feed conversion efficiency and rapid weight gain?
 - A. Agro-industrial byproduct feeding system
 - B. Feedlots
 - C. Pasture-based systems
 - D. All of the above
3. Which of the following factors is considered when feeding cattle for fattening?
 - A. Nutrient composition of feeds
 - B. Nutritional requirements of the fattening cattle
 - C. Determining the roughage-to-concentrate ratio
 - D. All of the above
4. Which nutrient is responsible for providing energy in cattle feeds?
 - A. Protein
 - B. Fiber
 - C. Carbohydrates
 - D. Minerals
5. What is the recommended roughage-to-concentrate ratio for cattle during the fattening process?
 - A. 40:60
 - B. 50:50
 - C. 60:40 to 70:30
 - D. 80:20

6. What is the recommended approach for gradually transitioning animals to a grain-based diet?
- A. Remove all forage from the diet immediately.
 - B. Introduce a large amount of grain from the start.
 - C. Begin with small amounts of grain and gradually increase over time
 - D. Skip the transition process and switch to a grain-based diet abruptly.
7. Which material is used to measure the circumference of the animal's chest?
- A. Heart girth measuring tape
 - B. Body length measuring device
 - C. Tape measure
 - D. Digital caliper
8. Which record-keeping category helps in tracking the breeding and reproductive history of cows?
- A. Identification
 - B. Reproduction record
 - C. Health Records
 - D. Vaccination Records
9. Which method is used to establish a baseline weight at the beginning of the cattle fattening period?
- A. Regular weighing
 - B. Initial weighing
 - C. Body length measuring
 - D. Heart girth measuring
10. What is the purpose of using a crush or cattle handling system during weighing cattle?
- A. To measure body length accurately
 - B. To restrain the animals for safe handling
 - C. To estimate the heart girth of the animals
 - D. To calculate the average daily weight gain

Answers key for self-check questions

Self-check-5

1. C 2. B 3. A

Self-check-6

1. Forage, silage, hay, agro industrial by products
2. Nutrient composition of feeds, nutrient requirements of cattle, determine roughage to concentrate ratio, calculate daily total feed intake

Self-check-7

1. $ADG = (\text{Final weight} - \text{Initial weight}) / \text{Number of days}$
2. $\text{Weight (in kilograms)} = (\text{Heart Girth in centimeters} * \text{Heart Girth in centimeters} * \text{Body Length in centimeters}) / 300$

Self-check-8

1. A 2. C 3. B 4. F 5. E 6. D

Self-check-9

1. F 2. B 3. C 4. D 5. E

Project Work

LAP TEST 1	Carryout cattle fattening
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Instructions: Visit one model fattening farm and given necessary templates, tools and materials you are required to perform the following tasks within **3** hour. Select two animals 2 to measure their body weight.

Task-1. Write the feed sources that available for the form

Task-2. Measure the body weight of the selected 2 animals based on heart girth and body length measurement

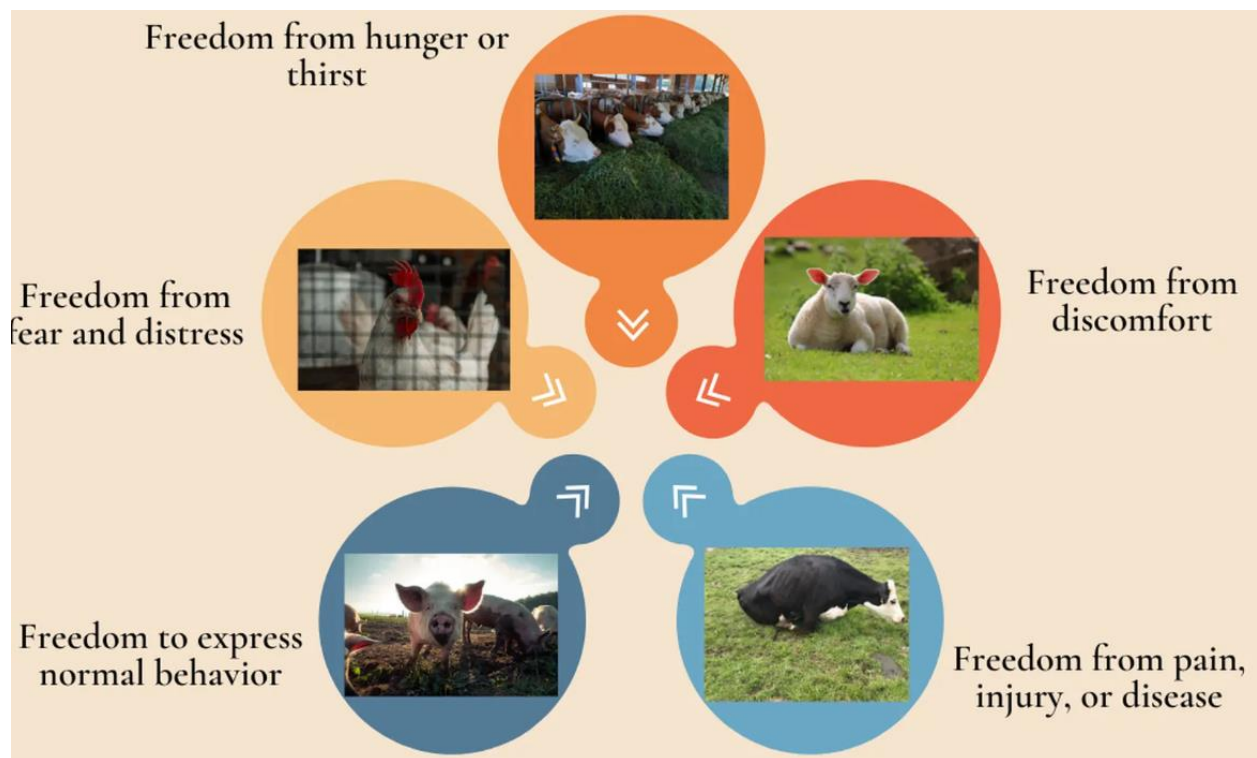
Task-3. Identify and write the record types with format that the farm you visited used

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MODULE IV

Professional Ethics



Contents

No		Contents	Page
		Module Description	247
1		UNIT 1: Developing Professions and Professionalism	248
	1.1	The Concept of Profession and Professionalism	259
	1.2	Characteristics of Professionalism in Workplace	259
	1.3	Values of Professionalism	261
		Unit Summary	262
		Unit Review Questions	262
2		Unit 2: The Concept of Ethics and Professional Ethics	263
	2.1	Fundamentals of Professional Ethics	264
	2.2	Common Principles of Professional Ethics	266
	2.3	The Importance of Professional Ethics	268
	2.4	Professional Ethics Required From a Worker	269
	2.5	Ethiopian Ethical Service Delivery	269
	2.6	Characteristics of Work Ethics	270
		Unit Summary	271
		Unit Review Questions	271
3		Unit 3: Ethical Practices In The Workplace	272
	3.1	Ethical Practices in the Workplace	273
	3.2	Factors that Affect the Practice Of Ethical Behavior	275
	3.3	Advantages And Implications of Respecting Workplace Ethics	276
		Unit Summary	277
		Unit Review Questions	277
4		Unit 4: Codes of Ethics, Conduct, and Standards of Professional Practice	278
	4.1	The Purpose of Professional Codes of Conduct And Practice	279
	4.2	Types of Codes of Ethics	280
	4.3	Code of Ethics Among Professionals	281
	4.4	Code of Ethics and Conduct	282
	4.5	Standards of Professional Practice	283
		Unit Summary	284
		Unit Review Questions	284

No		Contents	Page
5		Unit 5: Mechanisms of Professional Ethical Decision Making	285
	5.1	Ethical Decision Making	286
	5.2	Rationalization	288
	5.3	Moral Issues, Dilemmas and Judgments	288
	5.4	Steps to Ethical Thinking and Behaving	289
	5.5	Important principles for making Ethical decision	289
		Unit Summary	291
		Unit Review Questions	291
6		UNIT 6: Ethical Standards, Practice, And Employability Skills	292
	6.1	Ethical Standards and Practice	293
	6.2	Employability Skills	294
	6.3	Ways to Improve an Organization's Ethical Climate	298
		Unit Summary	299
		Unit Review Questions	299
		References	300

Module Descriptions

This module helps students to develop an understanding of a range of theoretical and practical techniques used in Professional Ethics in all industries. An industry is a collection of profitable businesses or establishments that manufacture or provide products, services, or revenue streams. It helps to develop skills that should enable them to participate more effectively and responsibly in today's work environment, to improve the management of organizational activities. By instilling ethical values, students are equipped to navigate ethical dilemmas in their personal and professional lives. Ethics also plays a role in shaping students' character and moral development, fostering qualities like empathy, compassion, and social responsibility. Professional ethics provide rules on how a person should act towards other people and institutions in such an environment. And it can eventually promote rational thinking and unbiased judgment among students.

Animal producers have a fundamental ethical obligation to prioritize the welfare and humane treatment of the livestock in their care. This means providing animals with appropriate food, water, shelter, space, and veterinary services to ensure their wellbeing. Practices that cause unnecessary suffering, such as extreme confinement or inhumane slaughter methods, are considered unethical. Producers must also be environmentally responsible, minimizing the ecological impacts of their operations through sustainable practices like manure management and energy efficiency. Upholding food safety and public health standards is another critical component, as producers have an ethical duty to deliver safe, high-quality products to consumers. Additionally, the fair and ethical treatment of farm workers, including compliance with labor laws, is an important ethical consideration. Overall, professional ethics in animal agriculture require producers to balance the interests of animals, the environment, workers, and the public good.

UNIT 1

Developing Professions and Professionalism

Learning Outcomes

At the end of this unit, the students will be able to:

- Explain the profession and professionalism.
- Describe the characteristics of professionalism.
- Identify the values of professionalism.

Key terms

- Occupation
- Profession
- Professionalism
- Skill
- Values
- Honest
- Ethics

Unit Introduction

This unit explores the importance of professionalism in the animal production industry and the ongoing efforts to establish and promote professional standards, ethics, and practices. As the animal production field continues to evolve, it is essential that professionals within this industry uphold the highest levels of competence, integrity, and responsibility. It play a crucial role in developing and enforcing codes of conduct, educational requirements, and industry best practices, all of which contribute to the professionalism of the field. The importance of continuing education and professional development, as ongoing learning and skill enhancement are vital for animal production professionals to stay abreast of the latest scientific advancements, technologies, and industry trends. The development and implementation of industry standards and regulations, particularly in areas such as animal welfare, environmental sustainability, and food safety. These standards not only ensure responsible and ethical practices but also enhance the credibility and professionalism of the animal production industry as a whole. The crucial role of public perception and communication in the animal production industry. Effective communication and public outreach are essential for improving the public's understanding and perception of the industry, and for addressing misconceptions and concerns that may arise.

1.1. The Concept of Profession and Professionalism

- What is a profession?
- Explain the term professionalism?
- Reflect on the value of professional ethics in our daily lives.

Profession and Professionalism

The concept of profession and professionalism in the context of animal production refers to the establishment and maintenance of specialized knowledge, skills, and practices that are recognized and valued within the industry. At the core of professionalism is the idea that animal production requires a unique set of competencies that go beyond simply working with animals.

1.2. Characteristics of Professionalism in Workplace

Professionalism in the workplace, particularly in the animal production industry, is characterized by a set of key attributes and behaviors that demonstrate a commitment to excellence and ethical conduct. Some of the key characteristics of professionalism in the workplace include:

1. Competence and Expertise

- Possessing the necessary knowledge, skills, and abilities to effectively perform one's job duties.
- Continuously seeking out opportunities for professional development and staying up-to-date with industry trends and best practices.

2. Accountability and Responsibility

- Taking ownership of one's actions and decisions, and being accountable for the outcomes.
- Adhering to industry regulations, guidelines, and standards, and ensuring compliance.

3. Integrity and Ethical Behavior

- Consistently demonstrating honesty, trustworthiness, and a strong moral compass.
- Making decisions that prioritize animal welfare, environmental sustainability, and public health.

4. Effective Communication

- Communicating clearly, concisely, and respectfully with colleagues, clients, and stakeholders.
- Actively listening and seeking to understand different perspectives.

5. Teamwork and Collaboration:

- Cooperating with colleagues and contributing to a positive work environment.
- Recognizing the value of interdisciplinary collaboration and fostering a spirit of partnership.

6. Time Management and Punctuality:

- Effectively managing one's time and meeting deadlines.
- Demonstrating a commitment to punctuality and reliability.

7. Appearance and Professionalism

- Maintaining a professional appearance and adhering to workplace dress codes and grooming standards.
- Projecting a positive and professional demeanor in all interactions.

8. Continuous Learning and Improvement

- Actively seeking opportunities to expand one's knowledge and skills.
- Embracing feedback and using it to enhance one's performance and contribute to the overall success of the organization.

1.3. Values of Professionalism

What are professional values?

Professional values are the core principles, beliefs, and ideals that guide the behaviors and decision-making of professionals within a particular industry or field. In the context of the animal production industry, some key professional values include:

1. Animal Welfare

- Prioritizing the health, safety, and well-being of animals in all aspects of production and management.
- Promoting humane practices that minimize suffering and distress.

2. Environmental Stewardship

- Recognizing the impact of animal production on the environment and implementing sustainable practices.
- Advocating for the responsible use of natural resources and the protection of ecosystems.

3. Food Safety and Quality

- Ensuring the production of safe, high-quality, and nutritious animal-based products.
- Maintaining rigorous standards and protocols to prevent contamination and safeguard public health.

4. Integrity and Ethical Conduct

- Upholding a strong moral compass and a commitment to honesty, transparency, and accountability.
- Making decisions that are in alignment with industry codes of ethics and professional standards.

5. Continuous Learning and Innovation

- Embracing a spirit of curiosity and a desire to stay informed about the latest advancements in the field.
- Fostering a culture of continuous improvement and the adoption of evidence-based practices.

6. Professionalism and Expertise

- Demonstrating a high level of competence, expertise, and dedication to one's work.
- Upholding the reputation and credibility of the animal production industry.

7. Social Responsibility

- Recognizing the broader societal impact of animal production and the responsibility to address the concerns and needs of various stakeholders.
- Engaging in community outreach and public education efforts to build trust and understanding.

Unit Summary

Professionalism refers to an individual's conduct, behavior, and attitude. It calls for education, training, specialized knowledge, and abilities. It is expected of professionals to behave professionally, use sound judgment, and show consideration for both clients and coworkers.

Vocational paths or careers requiring advanced training, expertise, and abilities are referred to as professions. The ability to act morally and impartially in spite of one's emotions is known as professionalism. Experts accept accountability for their actions and collaborate well with others. A professional appearance, comprising appropriate clothing, good hygiene, and grooming, is one of a professional's attributes. By demonstrating a professional appearance, animal production professionals can build credibility, earn the respect of their colleagues and industry partners, and create a positive impression that reflects the standards and values of the organization.

Unit Review Questions

Direction: Write a short answer

1. What is a profession?
2. Explain the term professionalism
3. List out some characteristics of professionalism.
4. Mention at least five values of professionalism.

UNIT 2

The Concept of Ethics and Professional Ethics

Learning outcomes

After training this unit, the students will be able to:

- Describe the concepts of ethics and professional ethics.
- Identify some characteristics of work ethics.
- Explain the Principles of Common Professional Ethics

Key Terms

Professional ethics

Moral

Spirit

Code of ethics

Corruption

Identity

Benchmark

Unit Introduction

The animal production industry plays a crucial role in meeting the global demand for food and other animal-derived products. However, as this industry has expanded and intensified over the years, it has also come under increasing scrutiny regarding the ethical treatment of animals and the broader environmental and societal impacts of its practices.

Ethical considerations in animal production are multifaceted, spanning concerns about animal welfare, environmental sustainability, food safety, and the responsible use of emerging technologies. Similarly, the concept of professional ethics within the animal production industry has evolved to encompass the moral obligations and responsibilities that producers, researchers, and other stakeholders must uphold to ensure the industry's long-term viability and public trust.

This discussion will explore the core ethical principles and professional ethical frameworks that guide decision-making and practices in the animal production industry. By understanding the ethical underpinnings of this sector, we can better evaluate the industry's current state, identify areas for improvement, and work towards a future where animal production balances productivity, sustainability, and the humane treatment of all living beings involved.

2.1. Fundamentals of Professional Ethics

The fundamentals of professional ethics in the animal production industry can be summarized as follows:

1. Animal Welfare

- Ensuring the physical and psychological well-being of animals through proper housing, nutrition, veterinary care, and opportunities for natural behaviors.
- Minimizing pain, distress, and suffering throughout all stages of the production process.
- Adhering to animal welfare standards and regulations set by governing bodies and industry associations.



Figure 1: Animal welfare

2. Environmental Stewardship

- Implementing sustainable practices that reduce the industry's environmental impact, such as managing waste, conserving natural resources, and minimizing greenhouse gas emissions.
- Considering the long-term consequences of production methods on the surrounding ecosystems and biodiversity.
- Adopting innovative technologies and techniques that promote environmental sustainability.

3. Food Safety and Quality

- Ensuring that animal-derived products are safe, nutritious, and free from contaminants or adulterants.
- Maintaining rigorous quality control measures and adhering to food safety regulations.
- Providing transparent information to consumers about the origins, production methods, and composition of animal-derived products.

4. Ethical Research and Innovation

- Conducting research and developing new technologies in a responsible and ethical manner, with a focus on animal welfare and environmental sustainability.
- Obtaining necessary approvals and following established protocols for animal experimentation and testing.
- Communicating research findings and innovations transparently to stakeholders and the public.

5. Transparency and Accountability

- Maintaining open and honest communication with consumers, regulatory authorities, and other stakeholders about production practices and their impacts.
- Establishing mechanisms for independent auditing and compliance monitoring to ensure adherence to ethical standards.
- Responding promptly and appropriately to any concerns or issues raised by stakeholders.

6. Respect for Animals

- Recognizing the intrinsic value and sentience of animals, and treating them with respect, dignity, and compassion throughout the production process.
- Promoting the ethical treatment of animals as a core principle, rather than as a mere compliance requirement.
- Fostering a culture of empathy and care among all individuals involved in animal production.



Figure 2: Respect for animal

2.2. Common Principles of Professional Ethics

- Beneficence
 - Prioritizing the well-being and best interests of animals, ensuring that production practices maximize their health, comfort, and natural behaviors.
 - Actively seeking to improve the quality of life for animals under human care.
 - Considering the broader societal and environmental benefits of sustainable and ethical animal production practices.

- Non-maleficence
 - Avoiding or minimizing any harm, pain, or distress caused to animals during the production process.
 - Implementing safeguards and procedures to prevent accidents, injuries, or other negative outcomes for animals.
 - Ensuring that any necessary interventions or procedures are carried out in a way that minimizes suffering.
- Autonomy and Justice
 - Respecting the autonomy of animals, to the extent possible, by allowing them to engage in natural behaviors and making decisions that prioritize their interests.
 - Ensuring fair and equitable treatment of animals, without discrimination or bias based on species, breed, or other characteristics.
 - Advocating for the fair and ethical treatment of all animals involved in the production process.



Figure 3: Autonomy and Justice of animal

- Integrity and Honesty
 - Maintaining the highest standards of professional conduct, including truthfulness, transparency, and accountability.
 - Providing accurate and complete information to consumers, regulatory authorities, and other stakeholders about production practices, product quality, and any associated risks or concerns.

- Upholding the ethical principles of the profession, even in the face of commercial pressures or competing interests.
- Responsibility and Sustainability
 - Considering the long-term environmental and societal impacts of animal production practices, and adopting sustainable approaches that minimize negative consequences.
 - Taking responsibility for the consequences of one's actions and decisions, and being accountable to various stakeholders.
 - Continuously seeking to improve and innovate in ways that enhance the ethical and sustainable practices of the industry.
- Collaboration and Peer Support
 - Fostering a culture of cooperation, mutual respect, and peer support among professionals in the animal production industry.
 - Sharing knowledge, best practices, and innovative solutions to address common ethical challenges.

2.3. The Importance of Professional Ethics

The importance of professional ethics cannot be overstated. It is essential for building trust and credibility with clients, colleagues, and the wider community. It also helps to maintain the integrity and reputation of the profession and ensures that professionals are held accountable for their actions. A professional code of ethics is designed to ensure employees are behaving in a manner that is socially acceptable and respectful of one another. It establishes the rules for behavior and sends a message to every employee that universal compliance is expected.

The following are some major importance of professional ethics:

- Moral awareness (proficiency in recognizing moral problems in engineering like plagiarism and patenting)
- Convincing moral reasoning (comprehending and assessing different views)
- Moral coherence (forming consistent viewpoints based on facts)
- Advance the quality of service. the quality of service that professionals could render
- Evaluate the performance of professionals in each profession.
- Distinguish between acceptable and non-acceptable characters or codes of conduct.
- Serve as a foundation for professional identity.

Being professional can ensure a positive first impression, successful interpersonal relationships, and a lasting reputation within your organization and industry

2.4. Professional Ethics Required from a Worker

Work is an activity that a person engages in regularly to earn a livelihood. Ethical requirements address the fact that all personnel on engagements should maintain independence in mind and in appearance, perform all professional responsibilities with integrity.

It serves as a benchmark for professionals to evaluate their activity and code of conduct accordingly. For example, a good mechanic would never repair one item in a car while sabotaging another part to malfunction later. It would be unethical to advertise a certain product as having certain qualities if it really does not. Some professional organizations may define their ethical approach in terms of a number of discrete components. Typically, these include honesty, trustworthiness, transparency, accountability, confidentiality, objectivity, respect, obedience to the law, and loyalty.

2.5. Ethiopian Ethical Service Delivery

Ethical service delivery for animals in Ethiopia typically involves the following key elements:

1. **Veterinary Care Access:** Ensuring accessible and affordable veterinary services, especially in rural areas, to provide essential medical treatment, vaccination, and preventative care for domestic and livestock animals.
2. **Animal Welfare Regulations:** Implementing and enforcing regulations to protect animals from cruelty, neglect, and mistreatment. This includes rules around housing conditions, transportation, and slaughter practices.
3. **Humane Handling and Slaughter:** Promoting humane slaughter methods that minimize suffering for livestock animals used for food production. This may involve training for slaughterhouse workers and certification programs.
4. **Stray Animal Management:** Developing programs to humanely manage stray and abandoned animal populations, such as through sterilization, sheltering, and adoption initiatives.
5. **Community Education:** Conducting public awareness campaigns to educate Ethiopian communities about responsible pet ownership, animal welfare, and the importance of ethical treatment of all animals.

6. Collaboration with Stakeholders: Fostering partnerships between the government, veterinary organizations, animal welfare groups, and local communities to coordinate and strengthen animal protection efforts.

2.6. Characteristics of Work Ethics

A work ethic is a personal set of values that determines how any employee approaches their work. Employees with strong work ethics are highly motivated and produce consistently high-quality results. A good work ethic can be taught as long as more productive behaviors are clearly demonstrated to employees.

Among the many characteristics of work ethics:

1. Appearance: Displays proper dress, grooming, hygiene, and manners.
2. Attendance: Attends class, arrives and leaves on time, tells instructor in advance of planned absences, and makes up assignments promptly.
3. Attitude: Shows a positive attitude, appears confident and has true hopes of self.
4. Character: Displays loyalty, honesty, dependability, reliability, initiative, and self-control.
5. Communication: Displays proper verbal and non-verbal skills and listens.
6. Cooperation: Displays leadership skills; properly handles criticism, conflicts, and stress; maintains proper relationships with peers and follows chain of command.
7. Organizational Skill: Shows skills in management, prioritizing, and dealing with change.
8. Productivity: Follows safety practices, conserves resources, and follows instructions.
9. Respect: Deals properly with diversity, shows understanding and tolerance.
10. Teamwork: Respects rights of others, is a team worker, is helpful, is confident, displays a customer service attitude, and seeks continuous learning.

Unit Summary

The ethical and professional conduct of individuals working in animal production is of paramount importance, as their practices and decisions can have significant impacts on animal welfare, environmental sustainability, food safety, and public health. At the core of this ethical framework are the principles of respecting the wellbeing of animals, minimizing environmental harm, ensuring the safety and quality of animal-based food products, and considering the broader societal obligations associated with animal production.

Professionals in this industry must demonstrate a strong work ethic characterized by a deep commitment to animal health and welfare, meticulous attention to detail in following protocols and regulations, adaptability to adopt new technologies and practices, a dedication to continuous learning, and the ability to collaborate effectively with interdisciplinary teams. Furthermore, they must uphold principles such as prioritizing animal welfare, practicing environmental stewardship, maintaining food safety and quality standards, fulfilling societal obligations, demonstrating honesty and transparency, continuously seeking improvement, and respecting intellectual property.

By embodying these ethical principles and work ethic characteristics, animal production professionals can contribute to the sustainable and responsible management of animal resources, ultimately benefiting the animals under their care, the environment, and the communities they serve. This holistic approach to ethical and professional conduct is essential for ensuring the long-term viability and social acceptance of the animal production industry.

Unit Review Questions

Direction: Write a short answer to the following questions:

1. What is the importance of professional ethics?
2. List out some characteristics of work ethics.
3. Identify the common principles of professional ethics.
4. Explain at least three important principles of Ethiopian ethical service delivery

UNIT 3

Ethical Practices in the Workplace

Learning outcomes

After training this unit, the students will be able to:

- Evaluate the practices of ethics in the workplace.
- Identify ethical and unethical behaviors in the workplace.
- Explain factors that affect the practice of ethical behavior.

Key Terms

- | | |
|------------------|--------------------|
| • Nepotism | • Trust |
| • Undue pressure | • Culture coaching |
| • Embezzlement | • Apologize |
| • Abuse | • Accountability |

Unit Introduction

This unit discusses the fundamentals of ethical behavior and how organizations can establish ethical standards for their employees based on them. Ethics in the workplace sets the standard for right and wrong behaviors and helps build morally upright employees. It guides employees whenever they face an ethical dilemma. Ethics also plays a significant role in creating a positive ambiance, ensuring happiness, and improving cooperation and trust among team members. To implement workplace ethics, you need to start by understanding the basic concepts of ethical behavior in the workplace.

3.1. Ethical Practices in the Workplace

Ethical Practices of Livestock Farms

- Prioritize animal welfare through proper housing, nutrition, veterinary care, and humane handling practices
- Implement sustainable land management techniques to maintain soil health and biodiversity
- Recycle farm waste and byproducts as inputs (e.g., manure as fertilizer, crop residues as animal feed)
- Minimize pollution and environmental impact through responsible resource use and waste management
- Ensure worker safety and provide fair compensation and benefits

Ethical practices in the workplace for different types of animal farms,

1. Ethical Practices on Dairy Farms

- Maintain high standards of animal health and comfort (e.g., proper nutrition, bedding, veterinary care)
- Implement ethical milking practices that minimize stress and discomfort for the animals
- Ensure proper handling and storage of milk to maintain quality and food safety
- Provide workers with adequate training, personal protective equipment, and safe working conditions
- Explore ways to reduce the environmental impact of dairy operations (e.g., manure management, energy efficiency)

2. Ethical Practices on Poultry Farms

- Uphold strict biosecurity measures to prevent the spread of diseases and protect animal welfare
- Provide adequate space, enrichment, and natural lighting to support the birds' natural behaviors
- Adopt humane slaughter and processing methods that minimize suffering
- Implement waste management strategies to recycle litter and minimize environmental pollution
- Ensure worker safety and fair employment practices, including proper training and protective equipment

3. Ethical Practices on Livestock (Beef, Pork, Sheep) Farms

- Maintain high standards of animal welfare, including appropriate housing, nutrition, and veterinary care
- Use humane handling and transportation practices to minimize stress and injury during every stage of production
- Implement sustainable grazing and pasture management techniques to preserve land and water resources
- Explore opportunities to reduce the carbon footprint of livestock operations (e.g., feed optimization, manure management)
- Provide workers with a safe, healthy, and equitable work environment

What are ethical and unethical behaviors in the workplace? Identify some of them.

Ethical Behaviors in Animal Production

- **Ensuring Animal Welfare:** Treating animals humanely, providing appropriate living conditions, nutrition, and veterinary care to prioritize their wellbeing.
- **Environmental Responsibility:** Implementing sustainable practices to minimize the environmental impact of animal operations, such as responsible manure management and water conservation.
- **Food Safety and Quality:** Upholding rigorous food safety protocols to deliver safe, high-quality animal products to consumers.
- **Worker Protections:** Providing fair wages, safe working conditions, and reasonable hours for farm laborers.

- **Transparency and Honesty:** Being truthful and transparent about production methods to build consumer trust.

Unethical Behaviors in Animal Production

- **Animal Cruelty or Neglect:** Subjecting animals to inhumane treatment, excessive confinement, or failing to meet their basic needs.
- **Environmental Negligence:** Irresponsible practices that pollute the air, water, or soil, or deplete natural resources.
- **Compromising Food Safety:** Cutting corners on sanitation, using unapproved veterinary drugs, or allowing contamination.
- **Exploiting Farm Workers:** Underpaying employees, exposing them to unsafe conditions, or violating labor laws.
- **Deceptive Marketing:** Making misleading claims about production methods or animal welfare standards.
- **Conflicts of Interest:** Prioritizing profits over ethical considerations or succumbing to bribery/corruption.

3.2. Factors that Affect the Practice of Ethical Behavior

There are different factors that can affect the Practice of ethical behavior are individual and social Factors.

1. Individual Factors

Many individual factors affect a person's ethical behavior at work, such as knowledge, values, personal goals, morals and personality. The more information that you have about a subject, the better chance you will make an informed, ethical decision. For example, what if you had to decide whether to approve building a new company store? What if you did not have the knowledge that the store would disturb an endangered species nest? Without the appropriate knowledge, you could be choosing an unethical path.

Values are an individual's judgment or standard of behavior. They are another individual factor that affects ethical behavior. To some people, acting in an improper way is just a part of doing business. Would you feel that it is ethical to make up lies about your competitor just to win a contract? Some people's standard of behavior will feel that lying for a business financial win is not unethical.

Morals are another individual characteristic that can affect an individual's ethics. Morals are the rules people develop as a result of cultural norms and values and are, traditionally, what employees learn from their childhood, culture, education, religion, etc. They are usually described as good or bad behavior. Would you have good morals if you pushed a product on a customer that you knew was not going to help solve a problem?

Many ethical work situations will also be affected by a person's goals. Which characteristics do you feel are worthy to aspire to? Is financial gain ranked ahead of good character or integrity? If your personal goals are about acquiring wealth no matter what the consequence, then you might act unethical in the future.

Lastly, an employee's personality plays an important factor in determining ethical behavior. Do you enjoy risk or do you prefer the safe route? Individuals who prefer to take risks tend to have a higher chance of unethical conduct at work. For example, if you are willing to risk dumping chemicals into a nearby water supply to launch a profitable drug, then your riskiness could end up creating health issues in local citizens for the sake of financial gain.

2. Social Factors

Cultural norms, internet, friends and family are the major social factors that can affect ethical behavior. Different cultures have norms that vary from place to place in the business world. For example, you might have to face a request for a bribe in order to conduct business in certain countries. This might be unethical to you but considered an acceptable norm in their workplace.

3.3. **Advantages and Implications of Respecting Workplace Ethics**

Ethics is a way of thinking that encourages people to consider the impact of their actions on others and to act in a way that is good for the greater good. It helps us to determine what is right and wrong and to make decisions that are based on moral values.

Advantages of Ethics in the Workplace:

- i. It can stimulate positive employee behavior and create a positive ambiance in the workplace
- ii. Ensures management guides and mentors their employees in a healthy environment
- iii. A workplace with good ethics usually strengthens the bond employees have with their superior

- iv. It boosts productivity through employee performance and job satisfaction which in turn increases company growth.
- v. Bad workplace ethics can cause a strain in the relationship with company stakeholders
- vi. When it leaks (which it most likely will) poor behavior can be recorded and propelled into unsavory headlines online. This can lead to reputational damage to the brand name.

The ethical implication of an action implies or suggests what we believe about right and wrong. For example most of us believe it is wrong to buy or sell another human being. The success is debatable, but regulations addressing surrogate pregnancies attempt to ensure that people are not commercially produced and sold.

Unit Summary

Ethical practices in the workplace are crucial for maximum productivity output and career growth. Trust and mutual respect are essential for reducing workplace stress, conflict, and problems, improving communication, teamwork, and fostering peace. Workplace ethics are a dynamic set of values that vary by individual and organizational definitions. Employers and employees must follow these ethics to foster employee-employer and employee-customer relationships.

Unethical behavior in the workplace can be addressed through on-job training and development. Factors that affect ethical behavior include individual factors such as knowledge, values, personal goals, morals, and personality. Knowledge helps individuals make informed decisions, while values are judgments or standards of behavior. Morals are rules developed from cultural norms and values, and personal goals can also impact ethical work situations. Personality plays an important role in determining whether an individual's goals prioritize good character or integrity. Overall, ethical practices in the workplace are essential for a successful career and a healthy work environment.

Unit Review Questions

Direction: Write a short answer for the following questions

1. Explain the practice of ethics in the workplace.
2. Evaluate the practice of ethics in your organization/workplace/.
3. Compare and contrast ethical and unethical behaviors in the workplace.
4. Explain factors that affect the practice of ethical behavior.
5. Identify at least five unethical behaviors in your school/workplace?

UNIT 4

Codes of Ethics, Conduct, and Standards of Professional Practice

Learning outcomes

After end of this unit, the student will be able to:

- Explain the purpose of professional codes of conduct and practice
- Identify the main types of codes of ethics
- Explain the difference between a code of ethics and a code of conduct

Key Terms

Management

Compliance

Assessment

Code of conduct

Objectivity

Ethical code

Truthfulness

Integrity

Conflict

Harassment

Unit Introduction

This unit discusses the fundamentals of codes of ethics, conduct, and standards of professional practice. A code of ethics and professional conduct outlines the ethical principles that govern decisions and behavior at a company or organization. They give general outlines of how employees should behave, as well as specific guidance for handling issues like harassment, safety, and conflicts of interest.

A code of ethics is broader, providing a set of principles that affect employee mindset and decision-making. A code of conduct offers principles defining the ethics of a business, but it also contains specific rules for employee actions and behavior.

4.1. The Purpose of Professional Codes of Conduct and Practice

Explain the drive of Professional Codes of Conduct in your school?

Professional codes of conduct and practice serve a vital purpose in the animal production industry. These ethical guidelines define the fundamental principles and responsibilities that animal producers are expected to uphold, such as prioritizing animal welfare, environmental stewardship, food safety, and worker protections. By codifying these standards, professional codes help promote public trust and confidence in the safety and quality of animal products. They also maintain the integrity of the industry by discouraging unethical practices like animal cruelty, environmental pollution, food safety violations, and worker exploitation - behaviors that could seriously damage the reputation of animal agriculture. These codes provide a framework for accountability, allowing industry associations and regulatory bodies to hold producers responsible for adhering to the established ethical benchmarks. When faced with difficult decisions, producers can refer to their code of conduct to navigate the appropriate course of action based on the outlined principles. Furthermore, shared ethical standards contribute to consistency in industry practices, promoting overall quality control. Importantly, the periodic review and updating of these professional codes allows the animal production sector to continuously improve and adapt to evolving scientific research, consumer preferences, and sustainability challenges. In an industry where public trust is paramount, these codes of conduct and practice play a crucial role in upholding the ethical treatment of animals, environmental protection, food safety, and worker rights - all of which are essential for the long-term viability and credibility of animal production.

4.2. Types of Codes of Ethics

1. Industry-Wide Codes of Conduct

These are broad ethical guidelines developed and adopted by major industry associations, such as the National Cattlemen's Beef Association, National Pork Producers Council, or American Veterinary Medical Association. They establish overarching principles and responsibilities for the entire animal agriculture sector.

2. Commodity-Specific Codes

Some codes of ethics are tailored to particular animal commodities, such as the United Egg Producers Animal Husbandry Guidelines for U.S. Egg-Laying Flocks or the National Chicken Council Animal Welfare Guidelines. These provide more detailed, industry-specific ethical standards.

3. Organizational Codes

Individual animal production companies, farms, or cooperatives may develop their own internal codes of ethics to align with their specific values, policies, and operational procedures.

4. Professional Codes

Codes of ethics are also established by professional organizations representing animal scientists, veterinarians, livestock handlers, and other specialized roles within the industry. These help maintain high standards of practice within those disciplines.

5. Certification Program Codes

Certain animal production certification programs, such as Certified Humane or Animal Welfare Approved, have their own rigorous codes of ethics that producers must adhere to in order to receive certification.

6. Government Regulations

In some cases, ethical standards for animal production are codified through government regulations, laws, and oversight, such as the Humane Slaughter Act or the Animal Welfare Act in the United States.

4.3. Code of Ethics among Professionals

Professional practice standards means the set of documents that specify the legal and ethical requirements for professional practice that include the standards of practice and essential competencies for code of ethics, practice guidelines, regulations and bylaws.

The code of ethics usually includes the six universal moral values that state you expect employees to be:

- A. Trustworthy: Worthy of confidence specifically: being or deriving from a source worthy of belief or consideration for evidentiary purposes a trustworthy informant.
- B. Respectful: Respect for persons may perhaps be the most fundamental principle in all of ethics. Respect (full) calls on each and every one of us to respect the intrinsic dignity of all other people. If something is intrinsic to us, it is essential to our being and cannot be earned. It is a property of being a person.
- C. Responsible: Responsibility is an ethical concept that refers to the fact that individuals and groups have morally based obligations and duties to others and to larger ethical and moral codes, standards and traditions.
- D. Fair: Fairness is concerned with actions, processes, and consequences, which are morally right, honorable, and equitable. In essence, the virtue of fairness establishes moral standards for decisions that affect others. Fair decisions are made in an appropriate manner based on appropriate criteria.
- E. Caring: The ethics of care is a normative ethical theory that holds that moral action centers on interpersonal relationships and care or benevolence as a virtue.
- F. Good citizens: Celebrating diversity and differences; go to local ethnic festivals and introduce your child to friends who represent a variety of lifestyles, cultures and religions.

Advisers must be registered and certified or state regulators are bound by a code of ethics. This is a legal requirement and also a code of loyalty that requires them to act in the best interest of their clients. Certified public accountants, which are not typically considered fiduciaries to their clients, still are expected to follow similar ethical standards, such as integrity, objectivity, truthfulness, and avoidance of conflicts of interest. Professionals should obey by:

- Act with integrity, competence, diligence, respect, and in an ethical manner with the public, clients, prospective clients, employers, employees, colleagues in the investment profession, and other participants in the global capital markets.
- Place the integrity of the investment profession and the interests of clients above their own personal interests.

- Use reasonable care and exercise independent professional judgment when conducting investment analysis, making investment recommendations, taking investment actions, and engaging in other professional activities.
- Practice and encourage others to practice professionally and ethically that will reflect credit on themselves and the profession.
- Promote the integrity and viability of the global capital markets for the ultimate benefit of society.
- Maintain and improve their professional competence and strive to maintain and improve the competence of other investment professionals.

All companies will have a different code of ethics with different areas of interest, based on the industry they are involved in, but the areas that companies typically focus on include: integrity, objectivity, professional competence, confidentiality, and professional behavior.

A code of ethics in business is a set of guiding principles intended to ensure a business and its employees act with honesty and integrity in all facets of its day-to-day operations and to only engage in acts that promote a benefit to society.

4.4. Code of Ethics and Conduct

A code of ethics is broader in its nature, outlining what is acceptable for the company in terms of integrity and how it operates. A code of conduct is more focused in nature and instructs how a business' employees should act daily and in specific situations. A code of ethics is a guiding set of principles intended to instruct professionals to act in a manner that is honest and that is beneficial to all stakeholders involved. A code of ethics is drafted by a business and tailored to the specific industry at hand, requiring all employees of that business to adhere to the code.

A code of conduct is a set of rules outlining the norms, rules, and responsibilities or proper practices of an individual party or an organization. An ethical code of conduct is a guide to principles created to assist practitioners in performing business in the right way. A code of ethics can reinforce the values stated in the mission and vision of the company. A Code of Conduct applies the Code of Ethics to various relevant situations. A rule in the Code of Ethics might state that all employees will obey the law. A Code of Conduct might list several specific laws relevant to different areas of organizational operations, or industry, that employees need to obey.

A code of conduct applies to everyone within an organization, with each company having their own code of conduct that employees need to follow. A code of conduct is created by the employer to let their staff members know what is expected of them in terms of behavior in the workplace. A code of conduct is the most common policy within an organization. This policy lays out the

company's principles, standards, and the moral and ethical expectations that employees and third parties are held to as they interact with the organization.

Some codes of conduct sets the values and principles that we as employees follow in our interactions with each other and with our stakeholders such as customers and other business partners, our shareholders and the regulatory authorities. It forms the basis for our behavior and for the public image.

Dress codes and code of conduct

A dress code is a set of rules, often written, with regards to what clothing groups of people must wear. Dress codes are created out of social perceptions. All clothing should be clean, ironed and in good shape. Refrain from wearing clothes that have tears, rips or holes, even if it is the current fashion. All employees should maintain an acceptable level of bodily hygiene to ensure that interactions with other staff and clients remain positive and pleasant. It is a standard set to guide what is appropriate to wear under certain circumstances. Dress codes include social perception, norms, and purposes. The implementation of dress codes creates orderliness and safety. Dress code identifies you that you belong to the group, gives you a sense of belongingness.

Workplace policies and procedures

- Code of conduct.
- Recruitment policy.
- Internet and email policy
- Mobile phone policy
- Non-smoking policy
- Drug and alcohol policy
- Health and safety policy.
- Anti-discrimination harassment policy

4.5. Standards of Professional Practice

The standards of professional practice are an agreed upon set of ethical and professional standards. Members of the professions use these standards in developing their own codes and guide them daily as they continue their work. These include the following:

- A. Professional Services and Agreement with Institutional Mission and Goals
- B. Employment Relationships and Management of Institutional Resources
- C. Conflict of Interest and Legal Authority
- D. Equal Consideration and Treatment of Others
- E. Professional Behavior and Integrity of Information and Research
- F. Confidentiality and Research Involving Human Subjects
- G. Representation of Professional Competence and References
- H. Selection and Promotion Practices

- I. Job description and performance evaluation
- J. Campus Community and Professional Development
- K. Assessment

Unit Summary

Codes of ethics and conduct outline ethical principles that govern decisions and behavior at a company or organization. They provide general guidelines for employees to behave and provide guidance for handling issues like harassment, safety, and conflicts of interest. A code of conduct is broader, encompassing principles defining the ethics of a business and specific rules for employee actions and behavior.

There are three types of codes of ethics: compliance-based, value-based, and non-compliance-based. Compliance-based codes set guidelines for conduct and determine penalties for violations, while value-based codes address a company's core value system. Non-compliance-based codes may not promote a climate of moral responsibility within the company. Non-compliance-based codes may require more self-regulation than compliance-based codes.

In conclusion, codes of ethics and conduct are essential tools for organizations to ensure ethical behavior and compliance. Understanding the purpose, types, and differences between codes of ethics and conduct can help organizations better manage their ethical practices and ensure the well-being of their employees.

Unit Review Questions

Direction: Write short answer for the following questions

1. Explain the difference between a code of ethics and a code of conduct.
2. List out the main types of codes of ethics.
3. Explain the purpose of professional codes of conduct and practice.
4. Identify workplace policies and procedures.
5. Explain the drive of Professional Codes of Conduct in your school
6. List down the universal moral values that are expected from an employee.

UNIT 5

Mechanisms of Professional Ethical Decision Making

Learning outcomes

After training this unit, you will be able to:

- Identify mechanisms for ethical decision-making.
- Explain the important principles for making ethical decisions.
- Mention some steps to ethical thinking and ethical behavior.
- Identify the factors that impact professional and ethical decision-making.

Key Terms

Rationalization

Philosophy

Induction

Deduction

Monitoring

Value of nature

Empathy

Procedure

Respect

Recruitment

Safety

Compliance

Unit Introduction

This unit discusses the fundamental factors of ethical decision-making frameworks and theories. Ethical decision-making is the process by which you aim to make your decisions in line with a code of ethics. To do so, you must seek out resources such as professional guidelines and organizational policies and rule out any unethical solutions to your problem. Making ethical decisions is easier said than done.

Ethical decision-making is often guided by ethical frameworks or theories, such as utilitarianism, deontology, virtue ethics, or the principle of respect for persons. It requires critical thinking, empathy, and consideration of various perspectives to arrive at a well-reasoned and morally justifiable decision. Ethical decision-making refers to the process of evaluating and choosing among alternatives in a manner consistent with ethical principles. In making ethical decisions, it is necessary to perceive and eliminate unethical options and select the best ethical alternative. Integrity, respect, responsibility, fairness, compassion, courage, and wisdom are the seven principles of ethical decision-making

5.1. Ethical Decision Making

An ethical decision is one that engenders trust, and thus indicates responsibility, fairness and caring to an individual. Ethical decision-making requires a review of different options, eliminating those with an unethical standpoint, and then choosing the best ethical alternative. Ethical decisions generate and sustain trust; demonstrate respect, responsibility, fairness and caring; and are consistent with good citizenship. These behaviors provide a foundation for making better decisions by setting the ground rules for our behavior.

Decision-Making is necessary in order to deal with conflicting duties, loyalties or interests create moral dilemmas requiring decisions to be made and ethical decision-making involves the ability to distinguish right from wrong along with the commitment to do what is right. Workers are expected to make ethical and sound decisions in the workplace. Decisions should be made on the basis of established rules, regulations, procedures and practices.

Making good ethical decisions requires a trained sensitivity to ethical issues and a practiced method for exploring the ethical aspects of a decision and weighing the considerations that should impact our choice of a course of action. Having a method for ethical decision-making is essential. When practiced regularly, the method becomes so familiar that we work through it automatically without consulting the specific steps. Ethical decision-making is often guided by ethical frameworks or theories, such as utilitarianism, deontology, and virtue ethics.

The word utility is used to mean general well-being or happiness. Utility is the consequence of a good action. Utility, within the context of utilitarianism, refers to people performing actions for social utility. Social utility means the well-being of majority of the people.

Utilitarianism is a theory of morality that advocates actions that foster happiness or pleasure and oppose actions that cause unhappiness or harm. When directed toward making social, economic, or political decisions, a utilitarian philosophy would aim for the betterment of society as a whole.

Deontology is an ethical theory that uses rules to distinguish right from wrong. Deontology is often associated with philosophy that ethical actions follow universal moral laws, such as “Don't lie. Don't steal. Don't cheat.”

Virtue ethics is the quest to understand and live a life of moral character. This character-based approach to morality assumes that we acquire virtue through practice. Ethical decision making is first based on the distinction between statements that are factual and those that are value-based. Suggested information may be divided into two (true and untrue). It is wise to base decisions on truth and morally accepted facts. Ethical decision making is the process of identifying a problem, generating alternatives, and choosing among them maximizing ethical values while also achieving the intended goal. In short, ethical decisions should be fully informed, aware of laws, principles and rules, consciously and reflectively deliberated, intelligently, justifiable, and effectively implemented.

Everything we do, or don't do, is a choice that can affect our lives and the lives of others. Ethical choices are based on principled decisions, not on self-interest or easy-returns. Such principles are based on universal values that have been held across time, culture, politics, religion and ethnicity. Any decision can be evaluated in terms of these universal values or core ethical principles trustworthiness, respect, responsibility, fairness, caring and citizenship before making any decision the responsible person should consider the following points:

- There should be accurate and comprehensive information. As in any other decision-making process, facts and evidence must be organized beforehand.
- Relevant policy and legislation have to be considered
- The advice of others (i.e., professionals in a given area) should be sought before making any final decision.

In making ethical decision, it is necessary to:

- Notice and eliminate unethical options -right vs. wrong. Ethical thinking requires a sensitivity to perceive the ethical implications of decisions.
- Evaluate complex, ambiguous and incomplete facts. It is often difficult to obtain all necessary information.
 - Select the best ethical alternative. Resolve any ethical dilemmas-right vs. wrong. Not all ethical responses to a situation are equal.
 - Have ethical commitment, ethical consciousness, and ethical competency. Ethical thinking and decision making takes practice

5.2. Rationalization

Studying ethics involves attempting to find valid reasons for the moral arguments that we make. Most people already have general ideas or what philosophers call intuitions or presumptions about what they think is “right or wrong”. But a philosophical approach to ethics requires people to think critically about the moral ideas that they hold, to support or refute those ideas with convincing arguments, and to be able to articulate and explain the reasons and assumptions on which those arguments are based. The real value of discussing and debating ethical questions is not to win the argument or to score points against the other person. It is more important to provide carefully considered arguments to support our ideas, and to allow for rational and deeper understanding of the reasons underlying our beliefs, ideas and attitudes. Crucially, this requires careful listening to, analysis of and learning from the arguments that others make. Three forms of critical reasoning that individuals can use to justify their arguments are outlined below:

- Reasoning by analogy /comparison/ explains one thing by comparing it to something else that is similar, although different.
- Deductive reasoning applies a principle to a situation. For instance, if every person has human rights, and you are a person, then you have human rights like every person.
- Inductive reasoning involves providing evidence to support a hypothesis.

5.3. Moral Issues, Dilemmas and Judgments

Moral issues: are issues which raise normative questions the right and welfare persons and other sentient beings, and about character of the agent, in particular about the kinds of person we should strive to become. Abortion, euthanasia, capital punishment are some examples of moral issues.

Moral dilemmas: involve situation in which one can't escape deciding, in which not to decide is to decide, and in which doing nothing has the moral statues of doing something.

Moral judgment: refers to deciding what is right and what is wrong in human relations. Individuals are continually judging their own conduct and that of their fellows.

5.4. Steps to Ethical Thinking and Behaving

Steps in ethical thinking and behaving include the following:

- Clarify/ identify the relevant facts of the case/: Determine precisely what must be decided. What are the alternatives? Eliminate any impractical, illegal or improper alternatives.
- Assess/ identify the relevant ethical principles/: Separate facts from beliefs, desires, theories and opinions. Assess the influence of personal and/or collective world views on assumptions about 'fact'. Assess the credibility of the sources of information and the motivations of the stakeholders.
- Decide/identify other relevant ethical principles and resolve conflicts between them/: Are there some right vs. wrong choices? Classify any ethical dilemmas involving right vs. right choices and evaluate the viable alternatives by prioritizing the ethical values so that you can choose which values to favor.
- Implement/ decide on ethical principles and standards which are relevant to the case at hand/: Develop a plan to implement your decision in a way that maximizes the benefits and minimizes the costs and risks. Involve as many stakeholders as possible during implementation.
- Monitor/Reconsider any remaining conflicts between the case and ethical principles and standards /: Monitor the effects of decisions and be prepared to take alternative action based on new information.
- Reflect/identify whether the decision would withstand public security, and finally make decisions/: Review your decision making process. Will I do it differently next time? Were you fully aware of your own values and worldview during the process? What feedback should you seek?

4.5. Important principles for making Ethical decision

- Empathize with another. Put yourself in the other person's shoes and understand how they are feeling. Treat other people the way you would like to be treated.
- Demonstrate selflessness. Do not be selfish and put yourself before others. Do the right thing even when it might not be what you really want to do.

- Be fair. Ethical people are compassionate and caring. They are always honest and fair when dealing with others.
- Respect another's opinions and choices even when you disagree with them.
- Value nature. Do not view it as only a resource for sustaining life, but as a life force in and of itself.
- Act responsibly. Be a trustworthy and responsible person that others can rely on.

There are seven steps to ethical decision making

- Determining whether there is an ethical dimension to the issue requiring a decision.
- Collecting relevant information for ethical analysis.
- Evaluating information collected on the basis of whether the decision to be made will be in compliance with established regulations and values.
- Considering alternatives that can be made in the process to ensure the decision and the result are ethical.
- A decision should be made and implemented after the considerations.
- The final step is the review of the consequences resulting from the decision.

4.6. Factors that affect Professional and Ethical Decision making

There are three important factors that can influence ethical decision making, which are individual, organizational, and opportunity factors. All three of these factors can weigh heavily on a person during the decision-making process, especially in the workplace. No matter how a person comes to make a decision, there are usually three factors that influence a person's ethical decision-making process.

The first factor in the ethical decision-making process is called the individual. Individual factors can affect a person greatly when making ethical or unethical decisions. Every person will have a slightly different belief when it comes to individual factors. It is always best to talk with an employee or consult the code of ethics before making individual decisions.

The next factor is the organizational factor. The organizational factor can be defined as a set of values or norms that is shared by members or employees of an organization. Organizational factors can affect decision making if all of the employees or associates have negative views and make unethical decisions. Organizational factors can be affected by the people closest to the decision maker. If the organization and all of the employees believe in a code of ethics, then most likely the decision will be ethical.

The last factor is the opportunity factor. This can be defined as a situation that encourages or discourages a person. Opportunity factors are based on whether there are opportunities to make ethical or unethical decisions. If the company promotes to do whatever it takes

Unit Summary

Ethical decision-making is the process of evaluating and choosing among alternatives in a manner consistent with ethical principles. It requires critical thinking, empathy, and consideration of various perspectives to arrive at a well-reasoned and morally justifiable decision. The seven principles of ethical decision-making are integrity, respect, responsibility, fairness, compassion, courage, and wisdom.

Ethical decision-making is necessary to deal with conflicting duties, loyalties, or interests, and requires the ability to distinguish right from wrong and the commitment to do what is right. Workers are expected to make ethical and sound decisions in the workplace, based on established rules, regulations, procedures, and practices.

Ethical decision-making is often guided by ethical frameworks or theories, such as utilitarianism, deontology, and virtue ethics. Utility refers to general well-being or happiness, while deontology uses rules to distinguish right from wrong. Virtue ethics focuses on understanding and living a life of moral character.

Unit Review Questions

Direction 1- Write short answer for the following questions

1. Explain the universal moral values that are expected from an employee.
2. What is rationalization?
3. Identify some steps to ethical thinking and ethical behavior.
4. Explain the important principles for making ethical decisions.
5. Identify the factors that impact professional and ethical decision-making.

UNIT 6

Ethical Standards, Practice, and Employability Skills

Learning outcomes

After the end of this unit, the students will be able to:

- Identify ethical standards, practices, and employability skills.
- Explain the ways to improve an organization's ethical climate.
- Explain the importance of employability skills.

Key Terms

Employee

Digital Skills

Employability

Negotiation

Ethical Decision

Leadership

Ethical Thinking

Empowerment

Ethical Behaving

Communication

Initiative

Bad Patterns

Unit Introduction

In this module, we are discussing the development of good interpersonal and employability skills that are tantamount to success in your life and career. In today's always-connected world, everyone has immediate access to technical knowledge. Thus, people skills are even more important now.

Among the most useful skills are:

- Influence: Wielding effective persuasion tactics.
- Communication: sending clear messages.
- Leadership means inspiring and guiding groups and people.
- Change catalyst: initiating or managing change.
- Conflict management: understanding, negotiating, and resolving disagreements.
- Building bonds: nurturing instrumental relationships.
- Collaboration and cooperation: working with others toward shared goals.
- Team capabilities: Creating group synergy in pursuing collective goals

Employability is “a set of achievements, skills, understandings, and personal attributes that make graduates more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community, and the economy.”

Employability, therefore, is not just about getting a job; it is about a broader set of skills and attributes that will enable a graduate to be successful throughout their working life.

6.1. Ethical Standards and Practice

In order to promote Ethical standards and practice with clients, colleagues and others the following behaviors should be considered:

a) Be a Role Model and be Visible

Employees look at top managers to understand what behavior is acceptable. Senior management sets the tone for ethics in the workplace.

b) Communicate Ethical Expectations

An organizational code of ethics can reduce ethical ambiguities. The code of ethics should state the organization's primary values and the ethical rules that employees are expected to follow. Managers should remember that a code of ethics is worthless if leaders fail to model ethical behaviors.

c) Offer Ethics Training

Managers should set up seminars, workshops and similar programs to promote ethics in the workplace. Training sessions reinforce the organization's standards of conduct, to clarify what practices are and are not permissible, and to address possible ethical dilemmas.

d) Visibly Reward Ethical Acts and Punish Unethical Ones

Performance appraisals of managers should include evaluations of how actions measure up against the organization's code of ethics. Appraisals need to include how managers achieve these goals, as well as the goals themselves.

e) Provide Protective Mechanisms

The organization provides formal mechanisms that allow employees to discuss ethical dilemmas and report unethical behavior without fear of reprimand that could include developing roles for ethical counselors, ombudsman or ethical officers.

f) Enhancing the Workplace Model Behavior

A better workplace requires leaders to model behavior in every aspect of their role. In your career, the ability to demonstrate leadership with a sound ethical basis is essential to your success for any role.

6.2. Employability Skills

Have you an idea about the importance of employability skills in the job market? Discuss in groups

The employability as relating to “portable competencies and qualifications that enhance an individual's capacity to make use of the education and training opportunities available in order to secure and retain decent work, to progress within the enterprise and between jobs, and to cope with changing technology and labor market conditions. Individuals are most employable when they have broad-based education and training, basic and portable high-level skills, including teamwork, problem solving, information and communications technology and communication and language skills... This combination of skills enables them to adapt to changes in the world of work.

Employability skills are defined as skills required not only to gain employment, but also to progress within an enterprise so as to achieve one's potential and contribute successfully to enterprise strategic directions.

Core Employability Skills

Core skills refer to skills, knowledge and competencies that enhance workers ability to secure and retain a job, progress at work and cope with changes.

The core skills are:

1. Basic/foundation skills
2. Vocational/technical skills
3. Professional/personal skills
4. Core work skills

Important core skills necessary for employability skills include the following though it is not an exhaustive list:

- Communication skills that contribute to productive and harmonious relations between employees and customers;
- Teamwork skills that contribute to productive working relationships and outcomes;
- Problem-solving skills that contribute to productive outcomes;
- Initiative and enterprise skills that contribute to innovative outcomes;
- Organizational skills :planning and organizing skills that contribute to long-term and short-term strategic planning;
- Self-management skills that contribute to employee satisfaction and growth;
- Learning skills that contribute to ongoing improvement and expansion in employee and company operations and outcomes; and technology skills that contribute to effective execution of tasks.
- Numeracy skills : literacy in basic arithmetic and statistical tools
- Negotiation skill: ability to engage with others
- Valuing diversity and difference
- Digital skills (technology).

Importance of employability skills

Why is Employability Skills Important?

These set of "job-readiness" skills are, in essence, behaviors that are necessary for every job and are essential attitudes that allow you to grow in your career and also efficiently let you:

- Connect with co-workers
- Solve problems
- Be a part of and understand your role within the team
- Make responsible choices for your job and your career
- Be independent and take charge of your career

Elements of Employability Skills

Employability skills are transferable skills that are useful in nearly every job. They involve the development of an expertise, knowledge base or mindset that makes you more attractive to employers. Employability skills are also often referred to as employment skills, soft skills, work-readiness skills or foundational skills. They often improve your performance, minimize errors and promote collaboration with your coworkers, enabling you to perform your role more effectively.

Some employable qualities come naturally, while others can be acquired through education, work or daily practice. You may already have some of the key employment skills, but you can work to improve those skills and develop new ones. Here are 10 common employability skills that employers look for:

1. Communication

Communication is one of the most important employability skills because it is an essential part of almost any job. The communication process involves five elements: the sender, receiver, message, medium and feedback.

2. Teamwork

Good teamwork skills refer to the ability to work harmoniously with your colleagues to achieve a shared goal. Teamwork skills such as collaboration can increase your hiring chances because you may be able to help a company reach its goals more effectively.

3. Reliability

Reliability makes you more employable because it promotes trust between you and your employer. You are a reliable employee if you can consistently complete your tasks on time, deliver quality work and make minimal mistakes. You must also be able to respond to inquiries and emails promptly and only make promises you can keep.

4. Problem-solving

Problem-solving involves identifying key issues and their implications, having a clear understanding of problems and determining the most effective solutions. For more complex problems, you need to know how to divide them into smaller parts that are easier to understand and more manageable.

5. Organization and planning

Being able to organize and plan effectively is important because it helps you and your employer save time, effort and money by improving workflow. It ensures that assignments and projects are completed on time and prevents confusion and errors that can be costly to the company.

6. Initiative

Taking initiative means recognizing a problem and solving it, preparing for a potential crisis by taking preemptive action, taking advantage of opportunities and having a positive attitude.

7. Self-management

Self-management refers to the ability to perform job duties satisfactorily with little or no supervision. For higher-level employees, it also means delegating tasks to ensure you complete them on time. Additionally, self-managed employees can motivate themselves to deliver solid work performance consistently.

8. Leadership

Employers look for good leaders because they can benefit organizations in many ways. As a leader, you play an important role in ensuring that your team shares the same vision as the company and works in unison with other teams and departments to achieve a common goal.

9. Learning

Having strong learning skills means understanding new concepts and methods quickly, taking on new tasks, adapting to change and having the tendency to improve your knowledge and skills continually.

10. Technology

Companies search for candidates with technical skills to help them use the latest [technology](#) and stay ahead of their competitors. Depending on your job, the technology skills you need may vary greatly, from word processing and sending email to video editing and using programming languages.

6.3. Ways to Improve an Organization's Ethical Climate

a) Empowerment of Employees

One way to improve the ethical climate of your organization is to give employees more power over their work. If employees have an ethical code and more control over their work outcomes, they are likely to justify your trust in them to make the right decision. Empowerment also can produce better results from employees, such as more creative solutions to business problems, when implemented effectively. Give employees a reason to act more ethically and to be more innovative – such as to keep their autonomy over their work – and you will also increase your company's efficiency.

b) Communication Policies and Procedures

Improve your communication policies and procedures so that information will flow more smoothly and frequently between employees and managers. For example, assign a manager, HR specialist or ad-hoc team to create a series of training scenarios that teach employees the right thing to do in common situations faced in your company.

c) Discipline and Consequences

You can't expect all employees to comply with the ethics policy without some kind of discipline. Enforce your consequences for violations of the ethics policy evenly, regardless of the offender's high or low status. If you don't have the time to do this, delegate the job to a manager or HR director. Be sure to maintain careful documentation of employee violations in case you get sued over disciplining or terminating an employee for an ethical violation.

d) Changing Bad Patterns/Adverse Behavior/

As you look at employee behaviors and enforce your ethics policy, you might see patterns of unethical behavior. This might indicate that some rules and procedures need to be changed in the organization, even if it affects ways of doing things that save time or money or increase profits.

From a business standpoint, the short-term losses should be outweighed by the resulting improvement in the long-term reputation of your business.

Unit Summary

The development of interpersonal and employability skills, which are crucial for success in life and career. In today's connected world, people skills are even more important than technical knowledge. Key skills include influence, communication, leadership, change catalyst, conflict management, building bonds, collaboration, and team capabilities. Employability is a set of achievements, skills, understandings, and personal attributes that make graduates more likely to gain employment and be successful in their chosen occupations.

To promote ethical standards and practice, employees should be a role model and be visible. An organizational code of ethics should state the organization's values and ethical rules, and managers should communicate these expectations. Offering ethics training can reinforce the organization's standards of conduct and address ethical dilemmas. Performance appraisals should include evaluations of how actions measure up against the organization's code of ethics. Provide protective mechanisms for employees to discuss ethical dilemmas and report unethical behavior without fear of reprimand. Enhancing the workplace model behavior is essential for success in any role.

Employability skills are defined as skills required for a person to secure and retain decent work, progress within the enterprise, and cope with changing technology and labor market conditions.

Unit Review Questions

Direction 1- Write short answer for the following question

1. What are ways to improve an organization's ethical climate?
2. Why are employability skills important?
3. List down a minimum of seven personal attributes that job seekers should develop in different ways.
4. Discuss why employability skills are important more critical in this day. Share your understanding to others
5. Are you ready to enhance employability skills to be competent in this crowded job market? How?

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MODULE V

Pasture Establishment and Forage Preservation



Contents

No		Contents	Page
		Module Description	301
1		UNIT 1: Materials, Tools and Equipment for Pasture Establishment and Forage Preservation	302
	1.1	Materials, Tools and Equipment	304
	1.2	Occupational Health and Safety Hazards	309
		Unit Summary	311
		Unit Review Questions	311
2		Unit 2: Forage Preservation Methods and Pasture Establishment	315
	2.1	Pasture Establishment	315
	2.2	Preservation Methods	332
	2.3	Urea Treatment	336
		Unit Summary	339
		Unit Review Questions	339
		Project Work	340
3		Unit 3: Clean Upon Completion of Work	341
	3.1	Handling and Transporting Materials, Equipment and Machinery	342
	3.2	Waste Materials Management	343
		Unit Summary	348
		Unit Review Questions	348
		References	351

Module Description

This module describes the knowledge, skills and attitude required to pasture establish and preserve feed. It requires the ability to prepare pasture establishment, handle materials, tools and equipment, undertake pasture establishment activities, and clean up on completion of work. Pasture establishment and preservation work requires knowledge of safe work practices related to pasture production and preservation task including the use of related tool.

UNIT 1

Materials, Tools and Equipment for Pasture Establishment and Forage Preservation

Learning outcome

After the training, students will be able to:

- Select and check suitable Personal Protective Equipment used for forage preservation and pasture establishment
- Identify materials, tools and equipment used for forage preservation and pasture establishment
- Identify occupational health and safety (OHS) hazards associated with forage preservation and pasture establishment

Key Terms

- Tools
- Equipment
- OHS
- Materials







Unit Introduction







Mention the materials, tools and Equipment in pasture establishment and forage preservation?



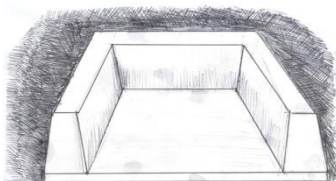


Materials refer to the physical substances or supplies used in construction, operation, or maintenance. In the context of pasture establishment and forage preservation, materials are the tangible items that are utilized to create, support, or enhance the desired outcomes. Examples of materials include seeds, soil amendments, fencing wire, water troughs, hay bales, plastic wrap, and mulch. These items are usually consumed or transformed during the process of establishing and maintaining pastures or preserving forage. Tools, on the other hand, are instruments or devices used to carry out specific tasks or operations. They are designed to facilitate manual or mechanical work. Tools are used to manipulate or work with the materials effectively and efficiently. Examples of tools in the context of pasture establishment and forage preservation include tractors, seed drills, mowers, rakes, balers, silage choppers, irrigation equipment, and hand tools such as shovels and pruning shears. Tools are the means through which materials are utilized or processed to achieve the desired outcomes. Equipment's are necessary items (the tools, clothing, or other items) needed for a particular activity or purpose. Example: Wheel barrow, water can, sacks, Water pump, sprayer.

1.1. Materials, Tools and Equipment

Table 1. Materials, Tools and Equipment for pasture establishment and forage preservation

Item	Picture	Use
Machete		A large heavy knife with a broad blade used as a tool for cutting through vegetation
Axe		A tool consisting of a flat heavy metal head with a sharpened edge attached to a long handle, used to chop wood or fell trees
Sickle		A short handled implement with a curved blade used for cutting tall grass or grain.
Mattock		Tool like a pickaxe with one end of its blade flattened at right angles to its handle, used for loosening soil and cutting through roots
Tractor		Farm vehicle (a motor vehicle) used for pulling heavy loads, especially on farms, where its large rear wheels enable it to move in fields
Shovel/spade		A hand tools consisting of a broad, usually curved blade attached to a long handle, used for lifting and moving loose material

Sprayer		Device that is capable of spraying liquid over an area. An atomizer or pressurized container that releases fine particles of a liquid
Watering can		A container with a handle and a spout, often with a perforated nozzle, used to water plants.
Water pump		Is a motorized device that can draw water from its source and pushes through pipe
Mower		A machine, often power-operated, that cuts grass with rotating blades
Baler		Is a farm machine used to compress a cut and dried crop (hay, cotton or straw) in to compact bales that are easy to handle, transport and store
Hay fork		Is a grapple device used for moving and turning hay.

Plastic sheet		Is a sheet of plastic used to cover and pack something? It can be used to cover inner surface of pit silo to prevent moisture and air from entering in to the silage.
Molasses		The thick sticky sweet syrup produced during the refining of raw sugar, which ranges in color from dark brown to gold
Silo		Is a structure or container used for storing fermented green feed known as silage. Silo can be pit silo, plastic bags, barrels and any structure constructed above the ground that can store green feed for fermentation
Wheel barrow		A small cart used to transport things, usually in the form of an open container with a single wheel at the front and two handles at the back
Tape measure		A long roll or strip of fabric, plastic, paper, or thin metal that is marked off in inch or centimeter/meter for measuring the length of something.

Importance of conducting pre-operational checks on Machinery, Tools and Equipments

- To identify the problems (defects, damages) of the Machinery, Tools and Equipments and take actions to correct or change them before using them
- To identify any hazards and risks that can be raised from using of the Machinery, Tools and Equipments and take minimization action timely

Risks associated with machinery Equipments and tools

- Using wrong equipment or/and tools for a job
- Not fitting adequate guards on machines leading to accident caused by entanglement, shearing crushing and trapping
- Not fitting adequate controls or wrong type of controls so that equipment cannot be turned off quickly and safely, or starts accidentally
- Not providing right information, instruction and training for those using the equipment
- Not maintain work equipment or carrying out regular inspections and thorough examinations
- Not providing the personal protective equipments needed to use certain equipments and machinery

Guidelines to conduct pre-operational checks on equipments and tools

- You should make sure that the Equipments and tools used for work are safe to use. Here is a list of actions that should be taken to ensure this is so.
- Perform a risk assessment to identify the hazards, the risks arising from those hazards and the control measures you should use
- Check that the equipment/tool is suitable for work and way in which it is going to be used
- Check that the equipment/tool is in good condition
- Make sure that the user knows which personal equipment to use and how to use it
- Think about who will use the equipment/tool including experienced workers, workers with language difficulties, new starter







Personal protective Equipment's (PPE)

Personal protective equipment is equipment that protects workers from different damages and injuries. Therefore, when we select this equipment's we should conduct process of selecting suitable PPE because:

- PPE is very important when building and maintaining structures.
- Where appropriate clothes for working outdoors, i.e. long trousers and a hat etc.

- Where thick protective gloves when required.
- Solid steel capped working boots will be essential to prevent any crushing injuries to the feet. Joggers are not suitable footwear unless they have steel caps.

Table- 2 personal protecting equipment's (PPE)

Materials	Picture	Description
Body safety cloth (<i>tuta</i>)		This cloth is a type of cloth which covers all the body part except the head and the fingers. It is used to protect the body from dirty.
Sun hat		Is the material, that is used to protect head from direct sun radiation
Eye protecting device		It is used to protect the eye from different damage
Boot		It is used to protect leg from sharpen and other damaging
Hand glove		Which is made of leather or strong flexible plastic rubber, it used to cover fingers to protect from sharpen materials.
Respiratory protection		Used for protect dust and chemical at work place

Self-Check -1

1. Which of the following is not an essential material needed for pasture establishment?
 - A. Grass and legume seed mixes
 - B. Pesticides
 - C. Fertilizer
 - D. Lime
2. Which tool is used to compact the soil after seeding to ensure good seed-to-soil contact?
 - A. Plow
 - B. Culti-packer
 - C. Broadcast seeder
 - D. Roto-tiller
3. Which equipment is used for chopping and ensiling forage crops?
 - A. Mower-conditioner
 - B. Hay rake
 - C. Silage harvester
 - D. Round baler
4. Which of the following is not a consideration for proper forage storage and maintenance?
 - A. Adequate moisture content
 - B. Pest management
 - C. Soil testing
 - D. Protection from weather
5. Which of the following is an important step in ensuring successful pasture establishment?
 - A. Applying herbicides
 - B. Irrigation
 - C. Soil testing and nutrient management
 - D. Planting non-native grass species

1.2. Occupational Health and Safety Hazards

Occupational Health and Safety (OHS): Any occurrence which results in personal injury, disease or death, or property damage. Occupational Health and Safety legislation requires businesses to provide employees and visitors with safe premises. This means having properly functioning machinery, as well as a suitable working environment with training and supervision. Many companies are searching for solutions that can provide effective communications to meet the monitoring and audit processes required to gain OHS & certification and comply with regulations.

There are many different situations where an incident may affect safety in the workplace and needs to be quickly and effectively communicated to the correct response teams. Perhaps you have personnel who handle dangerous chemicals and need to raise alarms when a leak or spill occurs.

Likewise, production companies have to monitor the product through every stage of the process. Notifications need to be in place to report any equipment failures, downtimes, or out-of-tolerance conditions that occur during these steps especially if your company is spread over multiple buildings and sites, and management needs to be informed when any safety or production incident occurs in another location

Hazard: is a situation that has the potential to harm a person, the environment or damage property.

Risk: is the probability (likelihood) of harm or damage occurring from exposure to a hazard, and the likely consequences of that harm or damage

Risk Assessment: is the process of evaluating the probability and consequences of injury or illness arising from exposure to an identified hazard.

Hazard Control: is the elimination or minimization of risk associated with an identified hazard.

Related to pasture establishment identification of expected hazards are by most caused by using unsafe hand tools and equipment, plant allergy, insects, spiders, snakes, poor manual handling. Therefore, the process of hazard identification should be guided by taking in to consideration of the above and other related situations.

Self-Check -2	Written Test
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Directions: Define the following terminologies

1. Hazard
2. Equipment
3. OHS

Unit Summary

Preparing materials, tools, and equipment for pasture establishment and forage preservation is a comprehensive training unit that aims to equip students with the necessary skills and knowledge to effectively gather and organize resources for successful pasture establishment and forage preservation.

When engaging in activities related to pasture establishment and forage preservation, it is crucial to prioritize occupational health and safety. It is important to be aware of the occupational health and safety hazards associated with these activities. Ergonomic hazards should be considered due to the repetitive nature of certain tasks, which can cause musculoskeletal disorders without proper ergonomics and lifting techniques. To mitigate these hazards and ensure occupational health and safety, it is essential to provide training and education on safe work practices. Implementing safety protocols, including the use of personal protective equipment (PPE), proper equipment maintenance, regular inspections, and promoting good ergonomics, can significantly reduce the risk of accidents and injuries.

Unit Review Questions

multiple-choice

1. Which of the following PPE is recommended when handling pesticides or fertilizers?
 - A. Gloves and goggles
 - B. Respirator
 - C. Protective clothing
 - D. All of the above
2. Which of these is a common tool used for pasture seeding?
 - A. Plow
 - B. Broadcast seeder
 - C. Silage harvester
 - D. Baler
3. Which of the following is a potential OHS hazard during forage preservation?
 - A. Exposure to dust and mold
 - B. Ergonomic issues from manual handling
 - C. Risk of entanglement in machinery
 - D. All of the above

4. What is an important OHS consideration when establishing a new pasture?

- A. Hazardous noise levels from equipment
- B. Avoiding contact with poisonous plants
- C. Proper storage and handling of chemicals
- D. All of the above

UNIT 2

Forage Preservation Methods and Pasture Establishment

Learning outcomes

After the training, students will be able to:

- Provide instructions and directions to pasture establishment
- Undertake pasture establishment activities and preservation methods to pasture establishment
- Undertake work task in a safe and environmentally appropriate pasture establishment

Key Terms

- Pasture
- Forage
- Hay
- Silage

Unit Introduction

How do you preserve forage in your area?

In the context of agriculture and animal husbandry, there is a distinction between pasture and forage: Pasture refers to a piece of land that is specifically cultivated and managed for the purpose of grazing cattle. It consists of a variety of grasses, legumes, and other herbaceous plants that are grown to provide feed for grazing animals. Pastures are often fenced and may be divided into smaller paddocks or fields to allow for rotational grazing. The primary objective of pastures is to provide a sustainable and controlled food source for cattle, allowing them to obtain their nutritional needs through grazing. Forage, on the other hand, is a broader term that encompasses any type of plant material that is consumed by grazing animals. It includes not only the plants grown in pastures but also naturally occurring plants in meadows, rangelands, and other uncultivated areas. Forage can include grasses, legumes, browse (woody plants), and even some agricultural crops that are grown specifically for feeding cattle, such as alfalfa or clover. Forage is essential for the nutrition and well-being of cattle, providing the necessary carbohydrates, proteins, and other nutrients.

Hay and silage are two common types of forage used as cattle feed. The sources of forage for hay and silage are as follows: Hay is forage that is harvested, dried, and stored for later use as animal feed. It is typically made from grasses, legumes, or a mixture of both. The source of forage for hay is primarily cultivated fields such as pastures and meadows. The plants are allowed to grow to a certain height, and then they are cut and left to dry in the field. Once the forage has dried sufficiently, it is baled and stored in a dry place to prevent spoilage. The drying process removes moisture from the forage, which helps inhibit the growth of microorganisms and preserves the nutritional value of the plants. Silage is a type of forage that is preserved through a fermentation process, making it suitable for storage and feeding over extended periods. The source of forage for silage can include whole plants or parts of plants such as corn (maize), grasses, legumes, or other crops. The forage is harvested at a specific stage of growth and chopped into small pieces. It is then compacted and stored in airtight conditions, such as in silos or wrapped in plastic, to exclude oxygen. The lack of oxygen promotes fermentation by beneficial bacteria, which convert plant sugars into organic acids, preserving the forage. Silage retains a higher moisture content compared to hay and provides a source of preserved forage that can be fed to cattle during periods when fresh forage is limited, such as winter months.

In summary, pasture refers to a managed piece of land specifically cultivated for grazing cattle, while forage is a broader term that encompasses any plant material consumed by grazing animals, including

plants within pastures as well as those found in natural and uncultivated areas. The source of forage for hay is dried grasses and legumes grown in cultivated fields, while the source of forage for silage can include whole plants or parts of plants that undergo fermentation and are typically grown as crops like corn or grasses.

2.1. Pasture Establishment

Pasture: is a land which is enclosed and separated from surrounding areas by fence or other barriers and devoted to the production of forage for harvest primarily by grazing

Forage: herbaceous plants or plant parts consumed by animals

Forage crop: plants grown primarily for cattle feeding and either used for grazing or harvested for green chop feeding, silage or hay

Browse: leaf and twig growth of shrubs, woody vines trees cacti and other non-herbaceous vegetation available for animal consumption

Types of pasture

A. Natural pasture

Natural grasslands extending over a wide area and composed of native grasses, herbs and shrubs valuable for forage and in sufficient quantity to justify grazing use are referred as rangeland or natural pasture. Natural pastures include annual and perennial species of grasses, forbs and trees.

Classification of natural forage

The wide diversity of natural vegetation used as forage can be classified as Geo-ecological or in functional terms. These are:

- Savannas in the tropics and sub tropics, essentially grassland either without trees or shrubs or with a crown of woody species covering up to 40% of the area.
- Steppes in Mediterranean and highland areas and in central Asia, normally with dry summers and rainfall in winter, when low temperature can severely limit plant growth. The vegetation consists mainly of perennial grass growing in tussocks, with some short lived annuals in the space between them.

- Semi-desert and desert vegetation, where rainfall is low and very irregular and plant growth is often confined to favorable sites, such as where run-off water flows in.
- Woodland and forests which have denser tree /shrub cover than tree savanna. The herbaceous undergrowth can be grazed, while the tree leaves, fruits, pods and seeds provide further important source of forage.
- Mountain vegetation, consisting of forest and meadows, and grassland above the limit of tree growth. Winter precipitation is often in the form of snow, both temperature and rainfall can limit plant growth.



Figure 1: Natural pasture

B. Improved pasture

Improved pastures have been reseeded, fertilized or fenced to improve productivity and utilization. This term is usually applied to rundown fields that have been renovated or rejuvenated. Areas seeded for pastures have several advantages over natural, unimproved pastures. They are higher yielding, with a better distribution of that yield over a longer grazing season. Usually newly established pastures have good legume content and therefore do not require nitrogen fertilization for good productivity.

Pastures can be established with the intention of supplying a grazing area for a short period of time or permanently. In long term pastures the plant composition will change with time. Established pasture stands are either harvested for conserving in the form of hay or silage or grazed in situ. Species such as Rhodes grass, Panicums, and alfalfa are highly productive. Under rain fed conditions, two harvests are quite common and the first harvest after mid-July is used for making silage. During this time, weather conditions make it impossible to make hay. The regrowth is then harvested for hay making, sometimes in October.



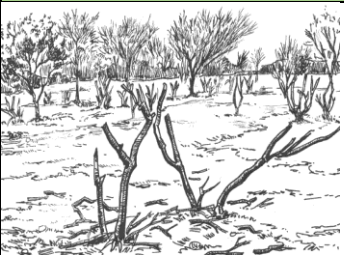
Figure 2: Improved grass


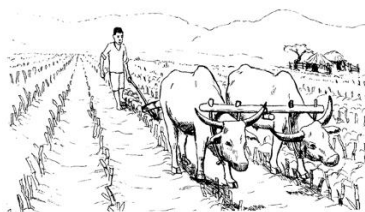





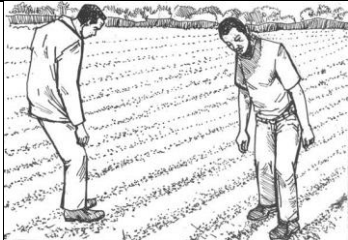

Figure 3: Improved legumes

2.1.1. Site selection and land preparation

Table -3 steps of site selection and land preparation

Steps	Images	Description
1.		<p><u>Site Selection</u></p> <p>Land should be selected from the areas where no natural grasses are found and is highly degraded bare land.</p> <p>Flat land is more preferable than slope land because of soil</p>

		erosion. In case manure is available, it is good if applied.
2.		<p><u>Land Preparation</u></p> <p>Plough the land once or twice. Particularly, a compacted land needs seed bed with minimum tillage. In case the soil is soft, no much cultivation is needed.</p> <p>In case of slope land, soil bund is helpful to save soils and seed from erosion and washing away.</p> <p>Areas should be fenced or protected from interference of cattle and wild life.</p>
3.		<p><u>Land tillage</u></p> <p>It reduces runoff and conserves water in the soil</p> <p>It reduces soil erosion and, improve soil structure and conserves organic matter in the soil</p>
4.		<p><u>Sowing pasture seeds</u></p> <p>In general, depth of sowing seed should be considered as 3 to 5 times of seed size (e.g. if a seed is 5mm, the depth should be 15mm to 25mm). 2cm is the maximum depth for grass forage. For bigger seeds such as forage legumes, 1.5 to 2cm is enough. Many of seeds will not germinate when the depth is deeper than 3cm.</p> <p>The left image shows “sowing grass forage seed” such as Buffel grass and Rhodes grass. At the level of knee, you can spread seed.</p>

5.		<p><u>Pasture Sowing</u></p> <p>The left image shows “sowing legume forage seed” such as cow pea and lablab. Drop a seed one by one at the level of ground.</p> <p>Seed rate differs according to the types of forage (e.g. grass forage, legume forage, and fodder tree). Please check the rate for each forage species as a following section explains.</p> <p>However, in general, too much seed rate suppresses the growth of forage. Therefore, low seed rate is more preferable than high seed rate.</p>
6.		<p><u>Covering Seed</u></p> <p>Cover the sown seed by using broom or cleared bushes.</p> <p>Amount of soil to be covered depends on the appropriate soil depth for each forage variety. In case of grass seed, the seed should be slightly covered by soil or be mixed with soil and broadcasted.</p> <p>In case of legume forage, cover the seed more carefully than grass forage. by Soil. It is also recommended to specify the date for sowing specific pasture seeds (e.g. Rhodes grass is sown on Friday and Pigeon pea is sown on Saturday).</p>
7.		<p><u>Compressing the Land</u></p> <p>Step on the land where people sown the seed by people's foot.</p>
8.		<p><u>Weeding practice</u></p> <p>Weed competes with the sown grasses and legumes for moisture, nutrients, space and light.</p>

Forage species selection

Selecting appropriate forage species is one of the most important and fundamental in establishing pasture.

When selecting forage species consider the following things

i. Land use objective

It is important to choose forage species that are capable of meeting your specific land use objectives of land use pasture.

The use objective may include:

- Increasing forage production
- Controlling erosion
- Reducing weed infestation
- Restoring the native forage community

If land use objective is increasing forage production, look for forage species that respond well to grazing and are productive and palatable to the animals. Soil and climatic characteristics of the site, It is critical that you select species that are adapted to the soil and precipitation characteristics of the chosen site. Annual precipitation is the most common determining factor for which species will successfully establish and persist on a given site. Do not select species that require more annual precipitation than a typical for the site if sowing depend on rainfall.

ii. Availability and cost of seed

Seed prices and seed supplies vary from year to year depending on production and demand. The forage species that can be obtained in least cost should be chosen.

iii. Selection of seed

Selection of quality seed is the important aspect towards the success in the establishment of pasture. Seed quality can be determined by proportion of seed that would germinate to form in to healthy plants. The following points should be considered while selecting a seed for pasture establishment.

A. Seed viability

The viability of any seed is its capacity to germinate when it is sown under suitable conditions for germinations. The purchased seed should contain only minimum quantity of dead seeds

B. Purity

The seed should be free from contamination due to the seeds of other species, inert material, pests and disease infestation, soil straw and the like

C. Seed size

Seed size is another aspect of quality seed and important component of seedling vigor. In germination stage seedlings are dependent of food stored in the seed. If the seed are bold and similar in the shape and size, then seedlings emerging from these will also likely to be similar in vigor and growth.

D. Seed dormancy

Seed dormancy is the resting period and a natural phenomenon which prevent seed germination. The reason for seed dormancy may be due to:

- Premature harvest
- Thick seed coat
- Chemicals which inhibit seed germination

2.1.2. Sowing, planting and management activities**I. Sowing practice**

- Choose a suitable location for your pasture based on factors such as sunlight exposure, drainage, and accessibility for cattle. Identify desirable time to seed non –irrigated areas is immediately before the season of the most reliable rainfall and when temperature is favorable. Sow perennial species at the onset of the longest wet season when the soil has received sufficient moisture to support germination and establishment.
- Prepare the soil by removing any existing vegetation, rocks, or debris. It's also advisable to conduct a soil test to determine its nutrient content and pH level. Based on the test results, you may need to add soil amendments such as lime or fertilizer to optimize soil conditions for pasture growth.

- C. Select the appropriate seed mixture for your pasture based on your specific goals and the local climate. Consider factors such as the desired forage species, grazing intensity, and soil type. It's often beneficial to use a mixture of grasses and legumes to improve the overall nutritional value of the pasture.
- D. Prepare a fine and firm seedbed to ensure good seed-to-soil contact. This can be done by tilling or plowing the soil to a suitable depth and then leveling it with a rake or roller.
- E. Distribute the pasture seed evenly over the prepared seedbed. This can be done manually by hand broadcasting or with the help of mechanical seed spreaders. Follow the recommended seeding rate provided by the seed supplier to ensure proper seed density. If necessarily treat a seed
- F. Gently incorporate the seeds into the soil by lightly dragging a harrow or rake over the seeded area. This helps to promote seed-soil contact and protects the seeds from birds or erosion. e.g. Space of seed to seed, between row and depth of the soil. Usually, grasses are sown at the depth of 1-1.5 cm depth, while the medium sized legumes seeds are sown at 2.5cm depth.
- G. After sowing, provide adequate moisture to the seeded area. Watering is essential for seed germination and early seedling establishment. Monitor the moisture levels and adjust watering accordingly to prevent under or overwatering.
- H. Implement weed control measures to minimize competition for nutrients, sunlight, and water. This may involve manual removal of weeds or the use of herbicides, depending on your preferred approach and the specific weed species present.
- I. Once the pasture begins to establish, implement appropriate management practices such as mowing or rotational grazing to encourage healthy growth and prevent overgrazing.
- J. Regularly monitor the pasture's progress, including its growth, weed presence, and overall health. Make adjustments as needed, such as reseeding bare spots or implementing additional fertilization.

1. Fundamental consideration for sown pasture establishment

- Make sure there is better chance of success where the rainfall is about 600mm or more
- Improved forage can behave as food crop in soil fertility requirements
- Topography must be convenient for easy farm operation and convenience of grazing animals

- Presence of power supply water, communication and road
- Make sure that the natural pasture has lost all the native desirable species and no future potential that replacing with improved species is absolutely necessary.

2. Agronomic procedures of establishing sown (cultivated) pasture.

- Selection of pasture mixture
- Mixed pasture composed of grasses and legumes are preferred to solid stand for the following advantages
 - ✓ More rapid establishment of the sward and better land use
 - ✓ Better seasonal distribution of growth. the grazing season may be extended by the inclusion of both early-and late maturing species
 - ✓ Increased production with greater palatability
 - ✓ Leguminous components increase the nutritive value of the sward
 - ✓ Legume fix atmospheric N and improve the nitrogen status of the pasture and soil

The advantage of establishing perennial mixed improved pasture on prepared seedbed for utilization by controlled grazing are:

- ✓ It produces a high yielding, high quality forage
- ✓ The legumes improve or maintain soil fertility
- ✓ It allows a high stocking rate, and high level of animal production with relatively low labor inputs

➤ The role of the legume in a mixed pasture sward

- legume have high protein content. they improve the palatability of a mixed grass-legume pasture by keeping the CP level above the critical level (7% of tropical species, 8.5% of temperate species) below which voluntary intake declines.
- Dry matter digestibility and voluntary intake of legume is generally higher than the grasses
- Legumes have high content of the mineral: calcium, sulphate, and phosphorus, thus they provide stock with more balanced diet
- Legumes play an important role through symbiotic Nitrogen fixation and the cycling of this nitrogen in to the pasture system

2.1.3. Pasture Management activities

Pasture management is the science or art of securing maximum sustained use of improved grazing land, forage crops with animal grazing without being detrimental or without any serious damage to the resources or use of the land. Grazing management is the manipulation of grazing animals to accomplish

desired results in terms of animal, plant or economic response. The main aim of grazing management practices is.

1. To provide a supply of nutritious herbage over the growing season at low cost
2. To avoid physical waste of herbage and inefficient utilization by the animal
3. To maintain the productive capacity of the sward.

I. Weeding

Weeding of pasture is essential for proper growth and development of forage, because weed compete with the sown grasses and legumes for moisture, nutrients, space and light. In the first year the first year of pasture establishment one weeding is required after 10 – 15 days of germination.

II. Fertilizer application

In areas receiving average annual rain fall up to 30mm, 20kgN AND 20KG P/ha should be applied as a basal dose at the time of sowing. But in the areas receiving average rainfall more than 30mm, this quantity can be increased by 40kg N and 20 kg P /ha. In case of more than one cutting, 20kgN/ha per cutting may be applied.

III. Pasture improvement strategies

Deterioration of pasture begins when undesirable species replace the valuable forage plants. Improvement of such deteriorated pasture includes protection of land for optimum period to allow establishment of new seedling, control of animal number and relief from overgrazing.

Desired vegetation can also be restored by seeding degraded pasture with suitable grass and legume species. Protection of pasture and controlled grazing alone increase the carrying capacity of pasture almost two to three times. Pasture can be improved by adopting the following

Techniques:

1. Fencing
2. Adoption of soil and water conservation measures
3. Re-seeding of pasture
4. Proper fertilization
5. Use of legumes
6. Weed and bush control
7. Proper grazing management
8. Pest control

IV. Grazing management

Grazing management should: balance cattle demand with forage availability, promote rapid pasture regrowth during the grazing season and promote long-term pasture persistence. The art of grazing management is to ensure that there is sufficient pasture in a stage suitable to graze at all times throughout the grazing season. Several grazing management systems define different methods of harvesting the forage. Therefore, knowing the decisive factors of stocking rate per a given pasture is important.

Determining the optimum stocking rate Proper stocking rate refers to limiting of the number of animals, which can be grazed in a given area of pasture or range. There are six main factors influencing optimum stocking rate.

1. The rate of forage growth

The amount of forage growth depends on where there is favorable climate present or not. Where there is favorable climate, high stocking rate may be employed consistent with improved pasture management practices that result in high rate of forage growth and dry matter accumulation

2. Accessibility of forage to animals

This may be limited by

- Problem of predators and theft

- Distribution of watering points in the pasture

3. The nutritive value of pasture

If high stock rate is employed on pasture with poor nutrient value, animals ingest high proportion of stem which cause a reduction in their performance

4. Botanical composition and ground cover

Heavy grazing due to use of high stocking rate may result in the following consequences:

- Favor shade intolerant species
- Cause invasion of weed
- Cause erosion hazard
- Seasonal variation in feed supply

Pasture growth varies with climatic especially rainfall. Thus, when deciding optimum stocking rate, consideration must be given to:

- The period of lower feed supply
- The amount of surplus feed for conservation

6. Nature of animal product

The sensitivity of the output to nutritional stress determines stocking rate e.g. milk is more sensitive than beef

Objective of proper grazing system are:

- To maintain a favorable balance between herbage species
- To maintain high production of good quality forage for the longest possible period
- To achieve efficient utilization of the forage produced
- To achieve high animal production

Grazing system refers to manner in which grazing and non-grazing periods are arranged within the maximum feasible grazing season, either within or between years. The grazing system selected must be adapted to the forage plant species being grazed, the grazing season, the physiographic of the grazing land, the nutritional needs of the kind and class of cattle to be grazed, and to the management objectives.

For a grazing system to be effective and practical, the following characteristics are commonly suggested.

- It is based on and suited to the physiological requirements and life history of the primary forage plant
- It will improve vegetation low in vigor or maintain vegetation already in high condition
- It is adapted to existing soil condition so erosion and puddling will not result from cattle trampling
- it will favor the desirable plants and promote high forage productivity
- it is practical to implement and reasonably simple to operate

Utilization of pasture is one of the most important aspects of pasture land management. For proper utilization the entire area should be divided in to number of blocks based on its carrying capacity and rotational grazing system should be applied. In this system of grazing, the sequence of grazing is changed in the way that each block is grazed for specific period and protected for the rest.

There are different systems of grazing like controlled, continuous, deferred, rotational, periodic grazing and etc. each of these has its merits and demerits. However, control of the number of animals grazing under any system is of prime importance. Grazing system in practices are as follows:

Types of grazing

1. Continuous grazing

This grazing type is an extensive system of grazing in which the stock remains on the same pasture area for prolonged periods. Continuous grazing has often been criticized as detrimental to the vegetation. However; the cause of deterioration commonly has been due to rather heavy grazing and poor distribution of grazing. Systems of grazing in which animals are allowed to graze freely over a particular area continuously is referred as continuous grazing. If number of animals allowed to graze is higher than the carrying capacity of grassland, there is fast depletion of desirable species and deterioration of grassland in due course of time.

2. Rotational grazing: is an intensive system of grassland management practiced on improved permanent or lay pasture. Rotation grazing is a generic term applied to moving grazing animals recurrently from one grazing unit (paddock) to another grazing unit in the same rotation series (group); in this regards, it is the opposite of continuous grazing.

In this type of grazing method, the grazing area is subdivided into a number of paddocks, usually at least six, and the animals are moved systematically from one to another of these in rotation. Each paddock is

grazed for a period of 3 to 7 days, the length of the grazing period depending on stocking rate and herbage growth rate.

Rotational grazing involves fencing a pasture into several small paddocks. Subdivision is a useful way to balance cattle needs with forage supply. Cattle graze the paddocks in sequence, moving to a new paddock when the forage is ready for grazing. In general, put cattle into a paddock when the forage is 25–30 cm tall; remove cattle when the pasture is grazed down to 8 cm. A relatively high stocking rate for the size of the paddock forces the animals to be less selective in their grazing and to graze the paddock off evenly. The animals are removed before they start to graze new plant growth and the paddocks are rested.

Dividing the fields allows some of the paddocks to be harvested for hay early in the season. This hay can be fed back if and when the pastures do not produce enough forage for the cattle. When planning the area to be cut, consider how much will be needed to support the cattle unit the hay aftermath is ready to be grazed. The later the first cut, the slower the regrowth. This delays putting the cut area back into pasture rotation and puts extra pressure on the grazed area.

The following terms are pertinent for describing and discussing rotation grazing, by definition a basic component of each grazing system:

Paddock: One of the grazing units or subunits included in a rotation group

Grazing period: One of a series of uninterrupted occupancies within a paddock

Non grazing period: A period of rest (i.e., grazing animals are prevented access to a specific area, ranging from a short period of a few days to a year or more.

Grazing period cycle: The sum of one grazing period and the following non-grazing
Grazing system cycle: The length of time required for all grazing methods

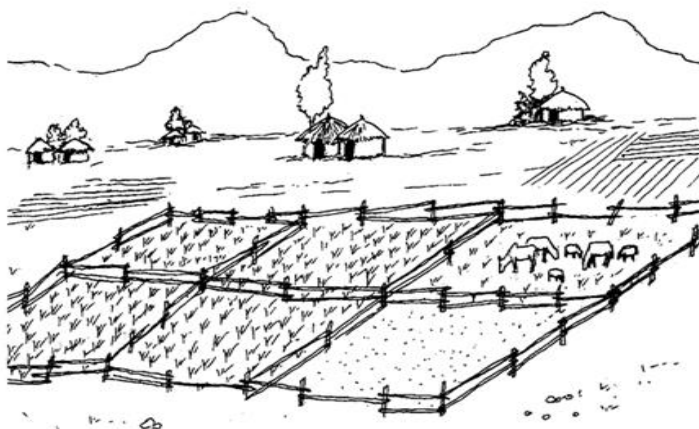


Figure:1 Rotational grazing allows the pasture to recover before it is grazed again

The major advantages of rotation grazing over continuous grazing on improved pasture are

- Improved plant persistence,
- Opportunities to conserve (mechanically harvest) surplus forage, and
- Efficient utilization of forage.

With rotation grazing, excess forage can be harvested as hay or silage for feeding during periods of low forage production; losses due to herbage trampling, fouling, and senescence are reduced by more timely utilization. On the other hand, continuous grazing has the advantage of lower input costs such as fencing and water facilities; also, management decisions are simplified because cattle are not being managed using high density and restricted area which require frequent moves from grazing unit to grazing unit.

Designing a Rotational Grazing System

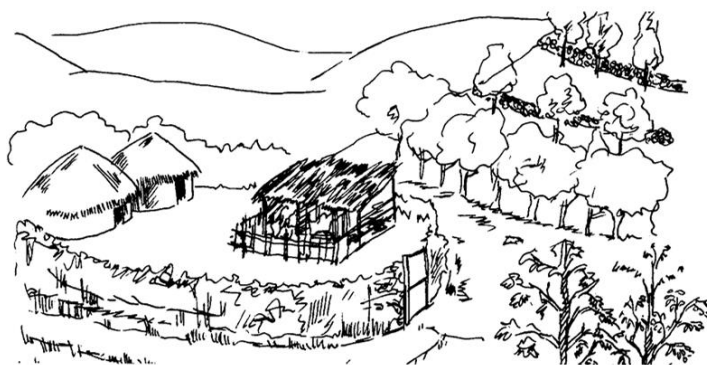
To design a rotational grazing system, inventory the:

- State of your pastures
- Layout of current fences
- Location of watering and handling facilities.

To keep costs reasonable, incorporate the existing fencing into the scheme. All paddocks must have access to water and the layout must accommodate this. An alley system is useful for moving cattle back and forth to a common destination. Estimate the productivity of the pastures.

Paddocks do not have to be the same size, but it makes it easier to manage them if they have a similar degree of productivity. Divide extremely productive pastures into smaller areas than poorly producing pastures. Set up paddocks on hills to run across the field, rather than up and down. This eliminates the selective grazing that normally takes place on slopes. If given the opportunity, cattle will camp on the top of hills and reject the forage at the bottom.

Soiling or zero grazing: is the feeding of cut crops to housed stocks. Bringing forage to animals has the advantages that animals can be tightly controlled, farmers can determine what the animals are offered to eat, manure can be collected easily, and the animals have less contact with certain biting flies and ticks. The soiling includes a wide variety of arable and forage crops. Zero grazing relates to feeding of crops which are normally grazed. There is higher production in zero grazing but the heavy labor demand makes it too expensive. Zero grazing is more suitable for all forage species where there can be excessive damaged by trampling and fouling of crop used in situ. It is also suitable for intensive production and for keeping animals in densely populated areas such as large villages or cities. However, it is very labor intensive: a cow may eat 40 or more kg of fresh forage daily, all of which must be brought to it.



Managing feed properly is easy if the livestock are confined in a shed

Figure 2: Zero grazing

Advantage:

- a. Efficient herbage utilization
- b. No loss due to trampling
- c. Uniform herbage intake
- d. Control bloat through wilting

Disadvantage:

- a. High cost for labor or machinery
- b. Bedding required for housed stock
- c. Manure disposal is laborious

self-check 3	
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1. What are the main steps in preparing the soil for pasture establishment?
 - A. Plow, disc, and smooth the seedbed
 - B. Apply lime and fertilizer based on soil test results
 - C. Both a and b
 - D. None of the above
2. When is the best time to plant a new pasture?
 - A. Early spring
 - B. Midsummer
 - C. Late fall
 - D. Time of year can vary depending on location
3. Which of the following is an important consideration for ensuring successful seed establishment?
 - A. Using a nurse or cover crop
 - B. Avoiding overgrazing during the first year
 - C. Controlling weeds
 - D. All of the above
4. How often should you test the soil and apply necessary amendments in an established pasture?
 - A. Every 1-2 years
 - B. Every 3-5 years
 - C. Only when you notice reduced productivity
 - D. Soil testing is not necessary for pastures

5. Which equipment is essential for planting a new pasture?

- A. Plow, disc, and harrow
- B. Broadcast or drill seeder
- C. Culti-packer or roller
- D. All of the above

1.2 Preservation Methods

Feed preservation: is keeping green animal feed (without very much loss of its quality) to use it during deficiency of green feed. Conservation of forage to bridge the gap in the supply and quality of fodder between wet and dry seasons is an applicable method of efficient utilization of feed resources.

Hay: is grass, legumes or other herbaceous plants that have been cut dried and stored for use as animal feed particularly for grazing animals

Silage: is fermented, high-moisture fodder that can be fed to ruminants.

Fodder: is any agricultural foodstuff used specifically to feed domesticated animal such as cattle, goats, sheep, horses, chickens and pigs and legumes.

1.2.1. Hay making



Hay is the most common and important conserved fodder used to maintain feed supplies throughout the year. Hay is produced by dehydrating green forage to a moisture content of 15% or less. It is generally the most convenient form of stored fodder and an appropriate forage conservation method for small-scale farmers and pastoralists with limited resources.

Where to use hay: Agro climatic zones Moist *Wurch*; all *Dega* and *Weyna-Dega*; Moist and Wet *Kolla*. Techniques of checking hay is dry or not Scrape the skin from a hay stem with your fingernail. If it peels off, the hay is still too wet. Dry it some more. Take a few hay stems and twist them in your hands. If the stems break a little and no juice comes out, the hay is dry enough. If it does not break, or if you see juice, dry it some more.



Table 4: Steps of hay making

Steps	Description	Image
1.	<p>Determine the optimal time for cutting the forage based on its stage of growth and weather conditions. Generally, forage should be cut when it is at the early flowering stage to ensure maximum nutrient content.</p> <p>Harvest Using a mower to cut the forage at the desired height, typically around 3-5 centimeters above the ground. Ensure that the mower is properly adjusted for an even and clean cut.</p>	
2	<p>After the crop is cut, it needs to be rake into windrows for drying. A tender or a rake is used to turn and fluff the cut crop, allowing air and sunlight to reach all parts of the plants. This helps to speed up the drying process and ensures even drying.</p>	
3	<p>Once the hay is sufficiently dry, bale it. There are different types of balers available, such as round balers or square balers. The baler collects the dried hay and compresses it into compact bales.</p>	

4	<p>Properly dry 15-20% the hay can be stored safely without heating excessively or becoming moldy. Maximum leafiness, green color, nutrient value and palatability can also be retained.</p> <p>Transport and store in a suitable location. They should be store in a dry, well-ventilated area to prevent moisture buildup and mold growth. Stacking the bales on pallets or using a hay barn can help to keep them off the ground and protect them from moisture.</p>	
5	<p>Feed to the animals. Remove the hay from all round a circular stack (not just from one side) to prevent the stack from collapsing</p>	

1.2.2. Silage making

Silage making is the best method of fodder conservation. Making silage involves cutting fodder at the optimum stage of development, chopping to the right size and proper compaction to create an air-tight condition. Made by storing green forage in an airtight condition for 45-60 days. Silage can be stored for many months before feeding it to animals. The best silage feels dry (though it contains 65-75% moisture), has a pleasant, acidic smell, and is green-yellow. Medium-quality silage smells sweet and is dark brown. Poor-quality silage is olive-brown, slimy, smells foul, and animals do not like to eat it. Suitable crops for silage include maize, sorghum and forage grasses. Using them to make silage means they cannot be used for grain, as the plants must be harvested before the seeds are mature (see below).

Where to use silage

Agro climatic zones: Moist and Wet Wurch and Dega; all Weyna-Dega; Moist and Wet Kolla.

Making a silo

A silo is where the silage is made and stored. Two types are useful for smallholders in Ethiopia: trench and circular. The silo protects the forage from rain and the air so it can ferment properly to make silage. The smallest silos are 4--5 cubic meters (2 x 2 m, and 1 m high). Larger silos can be many times this size. The silo should be big enough to feed the animals throughout the dry season (also taking into account the other sources of feed available, such as hay and fresh forage).

Steps of Silage Making

1. Harvest the crop to make silage from. The harvest time depends on the crop:
 - Maize: 50-55 days after silking.
 - Elephant grass: Before it reaches 1.5 m tall.
 - Grasses: Before they flower.
 - Oats: At the beginning of the dough stage.
 - Shrubs: At the end of the rainy season.
2. Chop the forage into pieces about 3-5 cm long. Chopping by hand is too slow, so it is best to chop using a machine.
3. Test the moisture content of the forage. If moisture comes out when you squeeze it, it is too wet. Leave it for a few hours so it dries out a little.
4. Fill the silo with layers of chopped forage. Compact each layer well by treading on it. This is important to make good-quality silage.
5. for grasses, mix some molasses with twice as much water and sprinkle it on the layers of forage as you put them into the silo. You will need 35 liters of molasses mixture for every cubic meter of silage.
6. When the silo is full, cover the contents with a layer of straw, inset leaves, plastic sheet, or any other material that can stop air and water from getting in. Pile stones or a 30 cm layer of soil on top to keep the pile compacted. If you are using a circular pit silo, consider building a thatched roof over the pit to keep out the rain.
7. Leave the forage to ferment for 45-60 days.
8. When ready, remove part of the covering and take out as much feed as needed for the day. Cover it again to keep out the air.

9. Give an adult cow 10-15 kg of silage per day. The animals may be unwilling to eat it at first, but they get used to it quickly.

1.3. Urea Treatment

Livestock can be allowed to graze on cropland immediately after the harvest, or the crop residue can be collected and fed to animals. Generally, cereal stalks (wheat, teff, barley, maize, sorghum) make poor-quality feed. However, the leaves make better quality feed than most natural grasses in the dry season. Mixing cereal stalks and leaves with pulse residues increases the quality of the feed. Crop residues have various other uses. For example, farmers often use cereal stalks as fuel or building materials. Consider using the most nutritious parts of the plant (the leaves) as feed, and leaving the stalks on the land to enrich the soil. To use crop residues as feed, collect them and stack them in a suitable place. Cover them to protect them from the sun and rain. If they get wet, they will go moldy and lose quality. Crop residues can be chopped up and mixed with molasses or treated with urea to make them more palatable and to improve their value as feed.

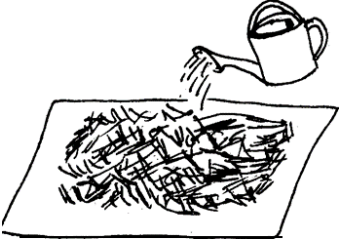
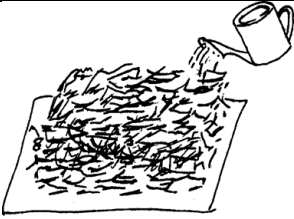
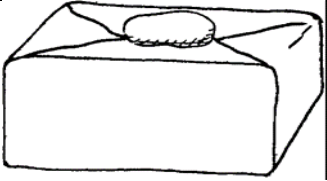
Treating straw with molasses

Molasses are a sticky, thick, brown liquid, produced when making sugar from sugar- cane. Straw treated with molasses is most often used to feed growing and fattening animals. Do not use molasses to feed milking cows. To treat straw, mix molasses with twice as much water, then sprinkle this on the crop residues. Alternatively, you can soak the residues in the water/molasses mixture over- night before feeding it. Treat only as much straw as you need each day. Do not give more than 2 liters of molasses to each animal in a day. Treating straw with urea before feeding it to the animals will help them gain weight.

Steps of Treating straw with urea

Make sure the plastic sheet does not have holes in it, or the ammonia gas that is formed will escape, and the treatment will not be as effective

Table 5: Steps of Treating straw with urea

Steps	Description	Image
1	Spread a layer of chopped straw on a large, thick plastic sheet and sprinkle it with a mixture of urea and water.	
2	Add another layer for straw and sprinkler with more urea and water. Repeat for several layers. For 100 kg of straw, you will need five 20-litre buckets of water and 6 kg of urea	
3	Wrap the plastic sheet over the top and sides of the pile so it is sealed completely. Put a stone on it to keep it air- tight	

4. Leave for 3 weeks.

5. Before feeding, open the sheet and take out enough treated straw for a day or two. Cover the rest of the stack with the plastic sheet.

Leave the straw you have taken out for several hours (or overnight) so the ammonia smell disappears. The following morning you can feed it to the animals. Take some more straw out that evening to feed the next day, and so on.

When you start to use the first pile for feeding, make a second pile the same size, following the steps above. After another 3 weeks, when the first pile is finished, you can start feeding from the second pile. Restart the first pile to make sure you have a continuous supply of straw. Animals may not like to eat the treated straw at first. To begin with, mix it with other feeds. You can gradually increase the amount of treated straw. An adult cow can be given about 6 kg of treated straw a day. Do not feed treated straw to calves younger than 6 months old. Straw is low in minerals, so provide a mineral lick in the shed.

Self-check -4	Written Test
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Directions: Answer the question below

- Which of the following is a common method of preserving forage crops?
 - Drying
 - Freezing
 - Ensiling
 - All of the above
- What is the typical moisture content range for properly dried hay?
 - 8-12%
 - 18-25%
 - 12-18%
 - 25-30%
- Which equipment is used to chop and pack forage crops for silage production?
 - Mower
 - Silage harvester
 - Hay rake
 - Baler
- What is the recommended moisture content range for ensiling forage crops?
 - 30-40%
 - 50-60%
 - 40-50%
 - 60-70%
- Which of the following is an important consideration for proper storage of hay or silage?
 - Adequate ventilation
 - Protection from weather
 - Pest management
 - All of the above

Unit Summary

Establishing pasture and preserving forages involves creating and maintaining an area of land specifically designed for the production of high-quality forage plants that can be consumed by cattle. This process is essential for ensuring a constant and nutritious food source for grazing animals throughout the year.

The establishment of pastures and preservation of forages offer several advantages. Firstly, they provide a consistent and high-quality source of nutrition for cattle, which can improve animal health, productivity, and overall farm profitability. Secondly, well-managed pastures can enhance soil health, prevent erosion, and promote biodiversity. Lastly, by reducing the reliance on purchased feeds, planters can reduce production costs and improve the sustainability of their operations.

Overall, establishing pastures and preserving forages is an important practice in cattle farming that promotes sustainable and efficient feed management while also contributing to environmental conservation and income.

Unit Review Questions

1. Which of the following should be the first step in pasture establishment?
 - A. Seeding the desired grass and legume species
 - B. Applying fertilizer and lime based on soil test results
 - C. Tilling the soil to create a smooth seedbed
 - D. Selecting the best location for the new pasture
2. Which of these preservation methods is commonly used for forage crops?
 - A. Drying and baling
 - B. Ensiling in a silo
 - C. Freezing
 - D. All of the above
3. What is an important safety consideration when operating machinery for pasture establishment?
 - A. Wearing appropriate PPE
 - B. Ensuring equipment is properly maintained
 - C. Avoiding distractions and working at a safe pace
 - D. All of the above

4. How can environmental impacts be minimized during pasture establishment?

- A. Avoiding the use of pesticides
- B. Implementing erosion control measures
- C. Proper management of livestock waste
- D. All of the above

Project Work

Instruction: Given necessary templates, tools and materials you are required to perform the following tasks within 2 hours for each task.

- Safety first (for yourself, friends, tools & equipment 's)
- Use right equipment for the right purpose
- Strictly follow the given procedures
- Put each tools and equipment and work shop after the session
- All steps were completed in the correct sequence

Task-1: Perform hay making

Task-2: Perform silage making

Task-3: Perform straw urea treatment

UNIT 3

Clean Upon Completion of Work

Learning outcome

After the training, students will be able to:

- Store waste materials in a designated area
- Handle and transport materials, equipments and machinery
- Return materials
- Cleaning, maintaining and store tools and equipment.

Key Terms:

- Waste
- Maintaining
- Recycling

Unit Introduction

What is waste during pasture establishment and forage conservation and how to recycling them?

The process of establishing pastures and conserving forage involves more than just the initial setup and maintenance. It also includes the important step of cleaning up and properly managing the debris, waste materials, and equipment used during the establishment process. This clean-up phase is crucial for creating a safe and clean environment, preventing potential hazards, and ensuring the overall aesthetics of the area.

To successfully complete the work for establishing pasture and forage conservation, it is essential to focus on the proper management and removal of waste materials. This includes storing waste materials in designated areas, handling and transporting materials, equipment, and machinery, returning materials to their appropriate places, and cleaning, maintaining, and storing tools and equipment.

3.1. Handling and Transporting Materials, Equipment and Machinery

To operate these work activity different materials, equipments and machinery are very important component of the work. These mentioned materials, equipment and machinery needs great care during handling and transportation. During handling and transportation, the users of these materials, equipment and machinery should give great emphasis to sustain their durability unless they may be exposed for different damage and for unexpected expense.

Self -check questions 5

1. When manually lifting heavy objects, you should:
 - A. Bend at the waist and lift with your back
 - B. Bend at the knees and lift with your legs
 - C. Ask a coworker to help lift
 - D. B and C
2. What is the primary purpose of using personal protective equipment (PPE) when handling materials?
 - A. To make the job easier
 - B. To protect against potential hazards
 - C. To comply with company policy
 - D. All of the above

3. When transporting oversized or overweight equipment, you should:
- A. Use the smallest vehicle available to save on fuel
 - B. Travel at normal highway speeds to get to the destination faster
 - C. Obtain the necessary permits and licenses
 - D. Disconnect all components before loading
4. Which of the following is an important consideration when loading equipment onto a transport vehicle?
- A. Maximizing the payload capacity
 - B. Ensuring proper weight distribution and balance
 - C. Using the cheapest tie-down materials available
 - D. Both a and b
5. Which of these is a key step in preparing machinery for transport?
- A. Fully fueling the equipment
 - B. Draining all fluids and immobilizing components
 - C. Leaving the operator's manual inside the cabin
 - D. None of the above

3.2. Waste Materials Management

3.2.1. Recycling waste materials

Returning materials is to go or come back, as to a former place/position after use.

The main purpose of returning material: -

- For re used next time
- To keep safely without broken after use
- Use resource wisely

The law says you must keep every part of your construction site in ‘good order’ and every place of work clean”. The objective is to achieve what is usually called a good standard of working site. In addition, all contractors must plan, manage and monitor their work so it is carried safely and without risks to health and environment. This includes careful planning on how the site will be kept tidy and work operation actively managed.

Safe and efficient waste materials storage depend on good co-operation and co-ordination between everyone involved including, client, contractors, suppliers and the residents.

- Storage areas- designate storage areas for Plant debris, Litter and broken components, Plastic, Metal, paper-based materials. These may be recycled, re-used, returned to the manufacturer or disposed of according to enterprise work procedures.
- Pedestrian routes- do not allow storage to 'spread' in an uncontrolled manner on to footpaths and other walkways. Do not store materials where they obstruct access routes or where they could interfere with emergency escape;
- Flammable materials- will usually need to be stored away from other materials and protected from accidental ignition. Storing of plants and materials involve diverse operations; such as hosting tone of cut wooden materials, piece of irons, destroyed seedlings, surplus plant and materials and others should be collected and stored properly during cleaning. The efficient storing of materials is vital to industry.

- Disposing waste materials

Definition: Waste disposing is placement or eradication of wastes, excess, scraps etc. under proper process. Is simply removal of excess or unwanted material safe.

Waste materials may include:

- Plant debris,
- Litter and broken components,
- Mulches, plastic, metal, and paper-based materials.
- Effluent from silage making

These may be recycled, re-used, returned to the manufacturer, or disposed of according to enterprise work procedures.

Classification/Type of waste, there are two types of wastes.

A. Solid wastes disposal

B. Liquid wastes disposal

Use/Purpose of disposing waste

- To remove waste and unwanted material safely from work site
- To clean work site suitably and make it attractive

Waste management

Is the proper handling of the things we throw away in a manner that does not harm anyone or anything, be it human, animals or the environment? Waste management may include waste reduction and segregation

A. Waste reduction, It is the prevention of waste material being created.

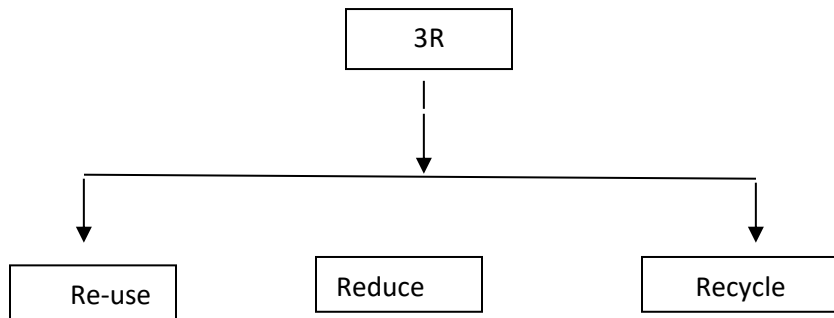


Diagram 3.1: Waste Reduction

B. Waste segregation:

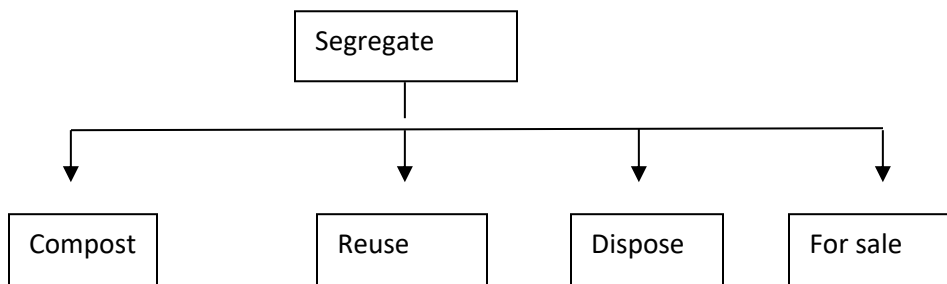


Diagram 3.2: Waste Segregation

Self-check questions 6

1. The first step in effective waste management is to:

- A. Segregate waste into different categories
- B. Identify and characterize all waste streams
- C. Implement recycling and reuse programs
- D. Properly store and label waste containers

2. Which of the following is an example of waste minimization at the source?

- A. Substituting a less hazardous chemical product
- B. Sending used materials to a recycling facility
- C. Transporting waste in a leak-proof vehicle
- D. Properly disposing of waste at a landfill

3. When storing waste materials, it is important to:

- A. Mix incompatible waste streams together
- B. Use unlabeled or unmarked containers
- C. Keep storage areas open to the elements
- D. Provide secondary containment and segregate wastes

4. Proper waste transportation requires:

- A. Using the fastest route possible
- B. Obtaining necessary manifests and permits
- C. Minimizing documentation requirements
- D. Allowing waste to be transported with other cargo

5. Good waste management practices should include:

- A. Regularly training staff on procedures
- B. Maintaining detailed records and reports
- C. Conducting routine audits and reviews
- D. All of the above

3.3 Cleaning, maintaining and storing of tools and equipment

The work place should be clear and safe always, this favorable situation encourages the workers to perform their task properly. To sustain clean and safe work site, this place should be cleaned before starting and after finishing their work.

Regular maintenance is essential to keep equipment, machines and the work environment safe and reliable. Lack of maintenance or inadequate maintenance can lead to dangerous situations, accidents and health problems. Maintenance is a high-risk activity with some of the hazards resulting from the nature of the work. Maintenance is carried out in all pasture establishment and all workplaces

Self-check questions 7

1. What is the primary purpose of regularly cleaning tools and equipment?
 - A. To make them look new and shiny
 - B. To prevent damage and extend their useful life
 - C. To comply with workplace regulations
 - D. Both b and c
2. When lubricating moving parts on equipment, you should:
 - A. Use the cheapest lubricant available
 - B. Apply it liberally to ensure full coverage
 - C. Follow the manufacturer's recommendations
 - D. Only lubricate parts that are easily accessible
3. Which of the following is an important step in proper tool and equipment storage?
 - A. Storing items in a cool, damp location
 - B. Allowing tools to be shared without tracking
 - C. Protecting sensitive components from the elements
 - D. Organizing storage based on how frequently each item is used
4. What should be included in a preventative maintenance program for tools and equipment?
 - A. Regularly scheduled inspections
 - B. Prompt repair of any identified issues
 - C. Replacement of consumable components
 - D. All of the above
5. Before storing tools or equipment long-term, you should:
 - A. Fully charge any batteries or power sources
 - B. Apply a thick layer of lubricant to all surfaces
 - C. Disassemble the item into its basic components
 - D. Thoroughly clean and dry the item

Unit Summary

The unit on clean-up on completion of work for establishing pasture and forage conservation emphasizes the proper management and removal of debris, waste materials, and equipment used during the establishment process. The objectives of the unit are to enable students to store waste materials in designated areas, handle and transport materials, equipment, and machinery, return materials to their appropriate places, and clean, maintain, and store tools and equipment.

The unit concludes with a focus on cleaning, maintaining, and storing tools and equipment. Students learn the benefits of regular cleaning and maintenance, including prolonging the lifespan of tools, optimizing performance, ensuring safety, and achieving cost savings. Proper storage practices are also emphasized to prevent damage and promote a professional image.

Self- Check-3	Written test
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Give a brief answer for the following question

1. Why cleaning, maintaining and store tools and equipment

Unit Review Questions

1. What is a key waste minimization strategy at the source?
 - A. Sending used materials to a recycling facility
 - B. Transporting waste in a leak-proof vehicle
 - C. Substituting a less hazardous chemical product
 - D. Properly disposing of waste at a landfill
2. What is a best practice for securely transporting materials off-site?
 - A. Mixing incompatible materials together
 - B. Using unlabeled or unmarked containers
 - C. Allowing waste to be transported with other cargo
 - D. Obtaining the necessary manifests and permits

3. What information is most important to document when processing material returns?
- The original purchase date and cost
 - The reason for the return and condition
 - The name of the employee processing the return
 - Both a and b
4. What is the primary purpose of regularly cleaning tools and equipment?
- To make them look new and shiny
 - To prevent damage and extend their useful life
 - To comply with workplace regulations
 - Both b and c

Answer keys of self-checks

Self-check 1	Self-check 3	Self-check 4	Self-check 5	Self-check 6	Self-check 7
1. B	1. C	1. D	1. B	1. B	1. D
2. B	2. D	2. B	2. B	2. A	2. C
3. C	3. D	3. C	3. C	3. D	3. C
4. C	4. A	4. D	4. D	4. B	4. D
5. C	5. D	5. D	5. B	5. D	5. A

Answer key self-check 2

- A hazard is any source, situation, or substance that has the potential to cause harm, injury, damage, or adverse effects to people, property, or the environment. Hazards can exist in various contexts, including workplaces, homes, public spaces, and natural environments. They can arise from physical, chemical, biological, ergonomic, or psychosocial factors. Understanding hazards is crucial for identifying risks and implementing appropriate measures to prevent accidents, injuries, or negative outcomes.

2. In the context of pasture establishment and forage conservation, equipment refers to the machinery, tools, and implements used to perform various tasks involved in these processes. Here are some examples of equipment commonly used in pasture establishment and forage conservation
3. OHS stands for Occupational Health and Safety. It refers to the field of study and practice that focuses on promoting and maintaining the health, safety, and well-being of individuals in their workplaces. OHS encompasses various principles, laws, regulations, and strategies aimed at preventing work-related injuries, illnesses, and accidents.

Answer key for self-check question 3

1. Why cleaning, maintaining and store tools and equipment

Cleaning, maintaining, and storing tools and equipment is important for several reasons:

1. **Prolonged Lifespan:** Regular cleaning and maintenance of tools and equipment help extend their lifespan. Removing dirt, debris, and rust prevents corrosion and deterioration, ensuring that the tools remain functional and effective for a longer period.
2. **Optimal Performance:** Clean and well-maintained tools and equipment tend to perform better. Removing built-up grime, lubricating moving parts, and replacing worn-out components can enhance their efficiency, accuracy, and reliability, leading to improved productivity and quality of work.
3. **Safety:** Tools and equipment that are not properly cleaned or maintained can pose safety risks. Malfunctioning or damaged tools may lead to accidents, injuries, or equipment failure. Regular inspections and upkeep help identify and address potential hazards, ensuring a safer working environment.
4. **Cost Savings:** Proper maintenance can help avoid costly repairs or replacements. By detecting and addressing minor issues early on, you can prevent more significant damage or breakdowns that may require expensive repairs or new purchases. Regular maintenance is often more cost-effective in the long run.
5. **Time Efficiency:** Well-maintained tools and equipment are less likely to break down or malfunction during use, minimizing downtime and interruptions in work. This translates to improved efficiency, reduced delays, and smoother workflow.
6. **Professional Image:** Clean and properly maintained tools and equipment reflect professionalism and attention to detail. Whether you are working on your own projects or in a professional setting, well-cared-for tools demonstrate a commitment to quality workmanship and create a positive impression.

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MODULE VI

Poultry Production Practices



Contents

No		Contents	page
		Module Description	352
1		UNIT 1: Poultry Production Systems and Materials	353
	1.1	Poultry Production Systems	354
	1.2	Materials, Tools and Equipment	359
		Unit Summary	366
		Unit Review Questions	366
2		Unit 2: Identify and Select Poultry Breeds	370
	2.1	Common Poultry Breeds	371
	2.2	Breeds Selection Criteria	380
		Unit Summary	386
		Unit Review Questions	386
		Project Work	387
3		Unit 3: Poultry House Construction and Facilities	389
	3.1	Site Selection	389
	3.2	Types of Poultry House	391
	3.3	Requirements for Poultry House Construction	393
	3.4	Poultry House Facilities	402
		Unit Summary	403
		Unit Review Questions	403
		Project Work	404
4		Unit 4: Poultry Management	408
	4.1	Poultry Feeding Managemen	409
	4.2	Ration Formulating for Classes of Chicken	412
	4.3	Routine Poultry Management Activities	417
		Unit Summary	433
		Unit Review Questions	434
		Project Work	436
5		Unit 5: Management of Common Poultry Diseases	439
	5.1	Common Poultry Diseases	441

No		Contents	page
	5.2	Routine Vaccination Program	447
	5.3	Poultry Farm Bio-security Activities	449
		Unit Summary	450
		Unit Review Questions	451
		References	458

Module Description

This module describes the performance outcomes, skills, knowledge and attitude required to categorize poultry production systems, identify the materials, tools and equipment; identify and select poultry breeds; plan poultry house construction and facilities; manage poultry and manage common poultry diseases.

UNIT 1

Poultry Production Systems and Materials

Learning Outcomes

At the end of this unit, the students will be able to:-

- Identify poultry production systems
- Identify materials, tools and equipment

Key Terms

- Equipment
- Extensive
- Intensive
- Semi intensive

Unit Introduction

What are the different types of poultry production systems?

Poultry production is a vital component of the global food industry, providing a significant source of animal protein and economic livelihood for many farmers and businesses worldwide. Poultry production systems refer to the various methods and approaches used to raise domesticated birds for meat (broilers) and eggs (layers). Poultry production systems can differ in terms of scale, management practices, housing, and the overall objectives of production. These systems are designed to optimize productivity, efficiency, and animal welfare while meeting market demands and ensuring food safety.

1.1. Poultry Production Systems

Poultry production systems refer to the methods and practices used to raise domesticated birds for meat (broilers) and eggs (layers). These systems can vary in scale, management, housing, and production objectives.

1.1.1. Extensive production system

It is a method of raising poultry in an open environment where birds have access to a large outdoor area for foraging and exercise. This system is characterized by a more natural and less intensive approach to poultry farming.

Table 1. Advantages and disadvantages of semi-intensive production system

Advantages	Disadvantages
Improved Animal Welfare: Birds have more space to move around and engage in natural behaviors.	Predator Exposure: Birds in extensive systems are more susceptible to predation from wildlife, increasing the risk of losses.
Natural Foraging: contribute to a more varied	Disease Transmission: by wild birds and pests.

diet.	
Enhanced Immune System: Exposure to a more diverse environment.	Environmental Impact: nutrient runoff and potential soil degradation.
Potential for Lower Stress Levels:	Space Requirements: require more land per bird
Access to Outdoor Areas: promoting physical activity and exposure to natural sunlight.	Economic Considerations: higher production costs and lower production efficiencies (low feed conversion and growth rates).
Diversification of Diet: Poultry can supplement their diet with insects, seeds, and vegetation from the outdoor environment.	Market Challenges: no consistent product quality and quantity.

1.1.2. Semi intensive production system

- Birds are provided with sheltered housing, typically in the form of sheds or structures.
- These housing facilities offer protection from predators, adverse weather conditions, and diseases.
- Although birds in the semi-intensive system are given some outdoor access allowing them to roam, forage, and engage in natural behaviors to some extent.
- They are also provided with supplementary feed.
- Involves more management and intervention compared to the extensive system. Farmers closely monitor the birds' health, growth, and overall welfare.
- They may implement feeding schedules, vaccination programs, and biosecurity measures to prevent diseases and optimize productivity.

Table 2. Advantages and disadvantages of semi-intensive production system

Advantages	Disadvantages
Balanced Animal Welfare: Birds have more space and opportunities for natural behaviors	Space Limitations: may impact the natural

compared to fully intensive systems.	behaviors of the birds.
Controlled Environment: allowing farmers to manage factors such as temperature, ventilation and lighting.	Higher Production Costs: due to the need for controlled housing and additional resources.
Higher Production Efficiency: in terms of feed conversion and growth rates.	Environmental Impact: have an environmental impact compared to extensive system
Moderate Land Requirements: compared to extensive systems, making them more suitable for areas with limited available space.	Disease Risks: Although better than extensive systems, may still face some disease risks
Improved Disease Management: better disease management compared to fully extensive systems.	

1.1.3. Intensive production system

- Birds are housed in specialized buildings, such as broiler houses or layer houses, which provide controlled environments. These buildings are designed to optimize space utilization, ventilation, temperature control, and lighting.
- The housing may be equipped with automated systems for feeding, watering, and waste management.
- High stocking densities, with a large number of birds housed in a relatively small area.
- Birds are provided with formulated diets that are specifically designed to meet their nutritional requirements.
- Primary objective of the intensive system is to maximize productivity and efficiency. This includes achieving high growth rates, maximizing egg production, and optimizing feed conversion ratios.
- It is commonly practiced in large-scale commercial operations.

Table 3. Advantages and disadvantages of intensive production system

Advantages	Disadvantages
Increased Production Efficiency:	Animal Welfare Concerns:
Higher Productivity: improved growth rates, higher egg production, and better feed conversion ratios.	Environmental Impact: generate significant amounts of waste, including manure and emissions.
Cost-Effective: efficient use of resources, bulk purchasing, and standardized management practices.	Disease Risk: The close proximity of birds in intensive systems increases the risk of disease outbreaks.
Enhanced Biosecurity: controlled environments with restricted access and biosecurity measures.	Dependency on External Inputs: such as feed, energy, and medications.
Year-round Production: enables a consistent supply of poultry products to meet market demands.	Public Health Concerns: antibiotic use, the emergence of antibiotic-resistant bacteria, and potential impacts on food safety.



Figure 1. Different types of poultry farming systems: (a) free-range (extensive) system (b) semi-intensive system (c) intensive: deep litter system, and (d) intensive: battery cages system.


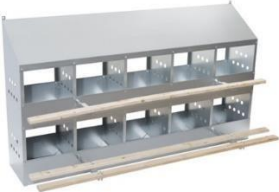

Self-check question -1	Written Test
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- One of the following is disadvantage of extensive poultry production system?
 - Require more land per bird
 - Enhances immune system
 - Minimum environmental impact
 - Low disease transmission
- High stocking densities, with a large number of birds housed in a relatively small area is one of the characteristics of intensive poultry production system. (True/False)




1.2. Materials, Tools and Equipment



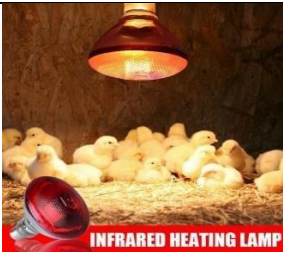

Do you know any tool or equipment commonly used in poultry farms?






Table 4. Equipment used for poultry raising activity





Name	Use	Picture
A. Housing and Enclosures		
Battery cage	Is the most common form of housing for hens that lay eggs in industrial agricultural settings.	
Laying nest	These are used to get clean eggs and to avoid floor eggs in layer or breeder houses.	
Perches	Perches allow them to perch at an elevated position, which can help them feel secure and comfortable, for exercise and muscle development, reduce floor soiling and improved foot health.	
B. Feeders		
Chicken tray feeders	Used to feed chicks under one week of age	

		
Automatic chick feeder	Used to automatically feed chicks and adult birds	
Hanging type plastic feeder	Used to feed chicks and adult birds	
C. Drinkers		
Bell type automatic waterer:	Provide automatic and continuous flow of water for layers, broilers and especially chicks. 14-16 drinkers/1,000 chicks should be provided within the brooding area of which 8-10 can be bell type drinkers.	
Nipple Drinkers:	Used for all types and classes of birds, but most commonly used in laying cages. Ensure that nipple drinkers are at the chicks' eye level.	

Manual drinker or fountain drinkers:	Are popularly used chicks during first week of brooding. Ease of giving vitamins /probiotics/ medicines/ vaccines through water.	
D. Feed processing machines		
Pelletizer	Compress and shape feed ingredients into compact pellets of a specific size and density to improved feed conversion efficiency, reduced feed wastage, and easier handling and storage.	
Feed mixer	Used to combine different feed ingredients and additives into a uniform and consistent mixture.	

E. Manure cleaning equipment		
Rake	This is used to rake the litter material in case of deep-litter system of rearing.	
F. Climate control equipment		
Ventilator	Temperature control, moisture control, gas and outdoor control, dust and particle removal, air circulation, ammonia and ammonia emission reduction	
Infrared heating lamp	Provide a focused and localized heat source for the chicks to maintain their body temperature	
Brooder	Equipped with heat sources, such as heat lamps or heating pads, to maintain an appropriate temperature for the chicks, because newly hatched chicks cannot regulate their body temperature	

Lighting equipment	Chickens need light to express their behavior. Light stimulates them, makes them more active. Helps them to find feed and water, nests, stimulate egg laying.	
G. Equipment for biosecurity		
Foot bath	Used to immerse the footwear of individuals entering or exiting a poultry house. To maintain biosecurity and prevent the introduction and spread of pathogens.	
Knapsack sprayer	Used for disinfecting the surroundings of the poultry house	
Poultry Vaccinator	To inject different doses of vaccine to large number of birds in shorter period either through intra-muscular or subcutaneous route.	
H. Incubation equipment		
Egg incubator	To provide optimal conditions for the artificial incubation of eggs.	

Egg Candler	To examine the contents of eggs by illuminating the eggshell.	
Debeaking equipment	To trim or modify the beaks of birds. For cannibalism and feather pecking prevention, to improve feed efficiency and growth	
I. Egg Handling and Processing		
Egg trays	Used for holding, storing and transporting eggs.	
Weighing scale	To weigh birds or feed for record and marketing purposes.	

Practical activity-1	Identify the different materials and equipment used in poultry production
----------------------	---

A. Resources required

- Equipment identification sheet

B. Procedures

1. Create an Equipment Identification Sheet:
 - Prepare a sheet with columns for equipment names, descriptions, and purposes.
 - Leave space to write down your observations during the identification process.
2. Visit a poultry farm and observe the equipment firsthand.

3. Start Identification:

- Begin with the equipment that you are already familiar with and confident in identifying.
- Use your Equipment Identification Sheet to record the name, description, and purpose of each equipment correctly.

4. Observe and Ask Questions:

- Carefully observe the equipment, noting its size, shape, materials, and any unique features.
- If you have the opportunity, ask the farm staff or experts about the equipment to clarify any doubts or gain additional information.

5. Compare and Cross-Check:

- Compare your observations and notes with the information available online or in reference materials.
- Cross-check to ensure accuracy and correct any mistakes or misconceptions in your identification.

6. Repeat the Process:

- Move on to the next equipment on your list and repeat the identification steps.
- Take your time, be thorough, and ensure that you understand the purpose and functionality of each equipment.

7. Review and Assess

If you encounter any difficulties or have uncertainties about specific equipment, consult with experts or experienced individuals in the field.

Self-check question -2**Written Test**

1. List three types of poultry feeders commonly used in poultry production.
2. List three types of poultry drinkers commonly used in poultry production.

Unit Summary

Each system has its advantages and challenges, and the choice of system depends on factors such as market demand, available resources, infrastructure, and management capabilities. It is important to implement appropriate management practices, prioritize animal welfare, address environmental concerns, and comply with relevant regulations to ensure sustainable and responsible poultry production.

Advancements in technology have led to more automated and sophisticated equipment aimed at improving efficiency, productivity, and animal welfare. These include battery cages, laying nests, different types of feeders and drinkers, feed processing machines, manure cleaning, climate control and biosecurity tools as well as egg handling and processing equipment.

Unit Review Questions

Part I Match the features described in column A with the appropriate production system under column B

	A	Answer		B
1.	Moderate stocking density and controlled environment		A	Extensive
2.	Improved animal welfare and balanced approach		B	Semi intensive
3.	High production efficiency and optimized space utilization		C	Intensive
4.	Limited outdoor access and higher stocking density			
5.	More space than intensive but less than extensive systems			

Part II Choose the correct answer from the following alternatives

6. What is the primary purpose of a poultry brooder?
 - A. Egg collection
 - B. Disease prevention
 - C. Providing heat to chicks
 - D. Automated feeding
7. Which equipment is used for dispensing feed to poultry in a controlled manner?
 - A. Nesting boxes
 - B. Egg graders
 - C. Ventilation systems
 - D. Feeders
8. Which of the following is a part of environmental control equipment in poultry farming?
 - A. Egg incubator
 - B. Automatic drinker
 - C. Water
 - D. Heat
9. What do automatic drinkers provide to poultry?
 - A. Feed
 - B. Light
 - C. Ventilation system
 - D. Egg grader
10. What is the primary purpose of a vaccination gun in poultry farming?
 - A. Egg collection
 - B. Disease prevention
 - C. Sorting eggs
 - D. Egg washing

Project Work

LAP TEST 1	Identify Poultry Production Systems and Materials
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Instructions: Visit one model poultry farm in the nearby area and given necessary templates, tools and materials you are required to perform the following tasks within **6** hours. Every student is expected to undertake the project individually.

Task-1. Perform identification of different poultry production systems in your area.

Answer key for self-check questions

Self-check question 1

Number	Answers
1	A
2	True

Self-check question 2

Number	Answers
1	Chicken tray feeders, automatic chick feeder and hanging type plastic feeder.
2	Bell type automatic waterer, nipple drinkers and manual drinker or fountain drinkers

Unit 2

Identify and Select Poultry Breeds

Learning Outcomes

At the end of this unit, you will be able to: -

- Identify common poultry breeds
- Undertake breeds selection

Key terms

- | | |
|-----------|-----------------|
| • Broiler | • Poultry breed |
| • Hen | • Rooster |
| • Layer | • Selection |

Unit Introduction




This chapter lists just a few examples of the best performing chicken breeds available globally and also some of the profound chicken in Ethiopia including indigenous ecotypes and introduced breeds. Each breed has its own unique characteristics, including egg-laying capacity, meat quality, growth rate, behavior, and adaptability to different climates. Breed selection procedures will also be described in this chapter including selection criteria for best performing layer and broiler breeds.



2.1. Common Poultry Breeds

What are the common chicken ecotypes currently available in Ethiopia?

1.1.1. The Ethiopian Indigenous chicken

Table 5. Characteristics of the Ethiopian indigenous chicken ecotypes


Chicken ecotype	Description
<p>A. <i>Farta</i> chickens</p> 	<ul style="list-style-type: none"> • <i>Farta</i> chickens are found in the <i>Amhara</i> regional state in northern Ethiopia. • The chickens have predominantly white body plumage that occurs at similar frequency in both sexes. • The other peculiar feature in males is a black breast (locally referred to as <i>libe tikur</i>), which is almost absent in females. • Live weight (gm) Male=1630 Female=1054
<p>B. <i>Mandura</i> chickens</p> 	<ul style="list-style-type: none"> • The <i>Mandura</i> population is found in the <i>Benshangul Gumuz</i> regional state in northwest Ethiopia. • The population of these chickens is relatively small. • Brown is the most predominant plumage in the population followed by red, white and <i>kokima</i> (white or grayish strips) • Live weight (gm) Male=1652 Female=1426
<p>C. <i>Horro</i> chickens</p> 	<ul style="list-style-type: none"> • Horro chickens are found in the <i>Oromia</i> regional state in western Ethiopia. • The size of the population is estimated to be about 29 800 . • Live weight (gm) Male=1700 Female=1372 Egg production
<p>D. <i>Konso</i> chickens.</p>	<ul style="list-style-type: none"> • These chickens are found in the former SNNPRS in south Ethiopia at altitudes ranging from 1,471 to 1,898 m.a.s.l. in a humid lowland to wet highland ecological zone. • The population is estimated to be approximately 107,600, and the major ethnic community keeping this population is the <i>Konso</i>.


	<ul style="list-style-type: none"> • Live weight (gm) Male=1411 Female=1011
<p>E. <i>Sheka</i> chickens</p> 	<ul style="list-style-type: none"> • The population of <i>Sheka</i> chickens is found in the former SNNPRS in south Ethiopia. • They are reared mainly by the <i>Sheka</i> and other very small populations of <i>Kaffa</i> and <i>Menja</i> communities. • The <i>Sheka</i> population is about 46,450. Brown is the predominant plumage followed by red, <i>zigrima</i> and black. • Live weight (gm) Male=1697 Female=1517

1.1.2. Exotic breeds of chicken

A. The egg breeds




Table 6. Characteristics of exotic chicken breeds (the egg breeds)

Egg breeds	Description
<p>A. White leg horn</p> 	<ul style="list-style-type: none"> • Excellent Egg Production (280-320 white-shelled eggs per year) • Small to Medium Size • White Plumage • Active and Energetic • Hardy and Disease Resistant
<p>B. Ancona</p>	<ul style="list-style-type: none"> • Mottled Plumage • Active and Agile • Good Egg Production (200-250 eggs annually) • Hardy and Adaptable

		
<p>3. Minorca</p> 		<ul style="list-style-type: none"> • large, upright single comb and long wattles • Large Size <ul style="list-style-type: none"> o Roosters (3.6-4.1 kg) o Hens (2.7-3.2 kg) • Exceptional Egg Production (around 200-250 large white eggs per year) • Hardy and Active • Docile Temperament
<p>A. Fayoumi</p> 		<ul style="list-style-type: none"> • Ancient Heritage (originated in Egypt) • Excellent Foragers, highly adaptable • Disease Resistance • Good Egg Production (150-200 small to medium-sized eggs per year) • Flighty and Active Nature • Are known to be present in Ethiopia




B. The meat types.

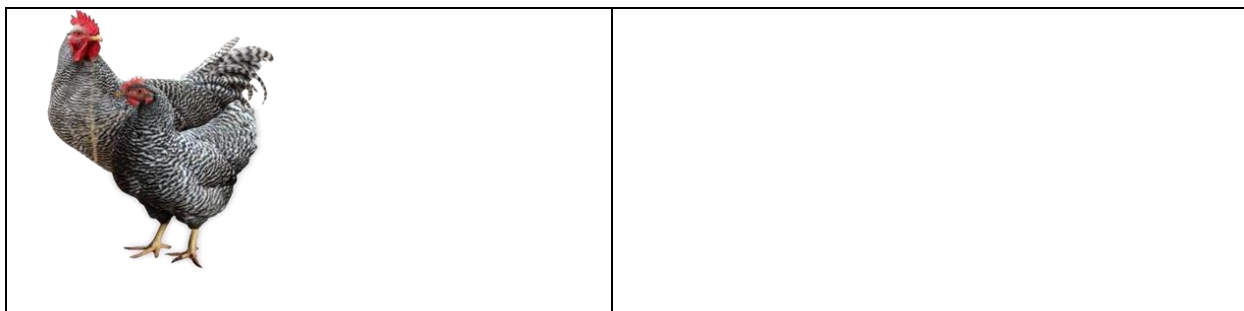
Table 7. Characteristics of exotic chicken breeds (the meat type breeds)

Egg breeds	Description
<p>A. Orpington</p> 	<ul style="list-style-type: none"> • Large Size <ul style="list-style-type: none"> ○ Roosters (4.5 kg) ○ Hens (3.6 kg) • Gentle and Friendly Temperament • Broodiness • Variety of Colors
<p>B. Cornish</p> 	<ul style="list-style-type: none"> • Compact and Muscular Build • Excellent Meat Quality • Rapid Growth <ul style="list-style-type: none"> ○ Rooster : (3.6 to 4.5 kg) ○ Hen : (2.7 to 3.6 kg) • Heat Tolerance, Docile Temperament
<p>C. Jersey Black Giant</p> 	<ul style="list-style-type: none"> • Is one of the largest chicken breeds <ul style="list-style-type: none"> ○ Mature roosters (5.9 to 6.8 kg) ○ Hens (4.5 to 5.4 kg). • Docile Temperament • Slow Maturity

C. The dual purposes breed

Table 8. Characteristics of exotic chicken breeds (dual purpose breeds)

Egg breeds	Description
<p>Rhode Island Red (RIR)</p> 	<ul style="list-style-type: none"> • Approximately 200 to 300 brown eggs per year • Hardiness, Excellent Foragers • Docile Temperament • Commonly kept in backyard flocks and small-scale poultry farms in Ethiopia
<p>New Hampshire</p> 	<ul style="list-style-type: none"> • Rapid growth rate <ul style="list-style-type: none"> ○ Roosters: (3.6 to 4.1 kg) ○ Hens: (2.7 to 3.2 kg) • 200 to 280 eggs per year, • valued for their meat quality • Hardy and Adaptability • Docile Temperament • Good Foragers
<p>Australop</p> 	<ul style="list-style-type: none"> • Rooster (3.2 to 3.6 kilograms) • Hen (2.3 to 2.7 kilograms) • Excellent egg layers • 250 to 300 large brown eggs per year • Efficient feed conversion • Decent meat quality, Hardy
<p>Potchefstroom Koekoek</p>	<ul style="list-style-type: none"> • Rooster (2.7 to 3.2 kilograms) • Hen (2.3 to 2.7 kilograms) • 200 to 250 eggs per year • Highly adaptable • Strong instinct for foraging • Vigorous Growth, Docile Temperament • Are known to be present in Ethiopia








1.2. Commercial Hybrid Chicken

In recent years, the use of hybrid chicken breeds in Ethiopia has gained some popularity, particularly in commercial poultry production systems.

- They lay more eggs, large, brown or white eggs
- They eat less feed per kg of weight gain for meat or per kg of eggs
- The hybrid broilers grow faster than pure breeds

Table 9. Characteristics of exotic chicken breeds (hybrids)

Layer hybrids	Description
Bovans brown 	<ul style="list-style-type: none"> • 300 to 320 large brown eggs per year • Efficient converters of feed into eggs. • Early Maturity: start laying eggs around 18 to 20 weeks of age • Docile Temperament, Adaptable • Egg Size and Quality: large-sized brown eggs, good shell quality
Isa brown	<ul style="list-style-type: none"> • 300 to 350 large brown eggs per year • Efficient converters of feed into eggs. • Early Maturity: 16 to 18 weeks of age • Calm Temperament

	<ul style="list-style-type: none"> • Adaptable, large-sized brown eggs
Broiler hybrids	Production performance
<p>Ross</p> 	<ul style="list-style-type: none"> • Rapid Growth: market weight within 6 to 7 weeks • High Feed Conversion Efficiency • Adaptable • Docile Temperament
<p>Cobb 500</p> 	<ul style="list-style-type: none"> • Rapid Growth: market weight within 5 to 6 weeks • High Feed Conversion Efficiency • Adaptable • Docile Temperament
Dual purpose hybrids	Description
<p>Sasso</p> 	<ul style="list-style-type: none"> • Market age is 16 to 20 weeks or even longer • Males: 2.5 to 3.5 kg • Female 2 to 2.5 kg • 150 to 250 eggs per year, adaptable

1.3. Difference in Productive and Reproductive Performance Among Local and Exotic Breeds of Chicken

Indigenous chicken breeds had low productive and reproductive performance than exotic breeds. The average age at first egg ranges 6-12 months for indigenous chicken. Their egg production potential ranges 30-60 eggs per year per hen with average egg weight of 38g under village management conditions; while under intensive system they produce 80-100 eggs per year per hen. Average hatchability of eggs was 80% for indigenous chickens. On the other hand, performance of exotic differs from indigenous chickens. Average age for first egg was 5 months for exotic chicken breeds under intensive management system in Ethiopia. Exotic breeds of chicken kept under intensive condition produce around 250 eggs /year/hen with average egg weight of 50-60g; while under village production system it may go down up to 150 with average weight of egg 44g. Average hatchability of eggs was around 70% for exotic chickens in Ethiopia.

Practical activity-2	Identify the different poultry breeds
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A. Resources required

- Poultry breeds samples
- Identification guide or reference material
- Labels or tags
- Observation sheets
- Cleaning and disinfection supplies

B. Procedure

- Visit a poultry farm.
- Identify any given breed of poultry based on the physical characteristics like body shape, plumage color, comb shape, color of earlobe, skin and shank, whether shank feathered or not and shape of neck and shank.
- Observe for the following body parts and note it down:

Body shape.....

Plumage color.....

Comb shape.....

Color of earlobe, skin and shank.....

Shank feathered or not.....

Shape of neck and shank.....

C. Results

The given bird belongs tobreed.

Self-check question -3	Identify the different poultry breeds
-------------------------------	--

1. Which poultry breed is known for its excellent egg production, white plumage, hardy and disease resistance features ?
2. Name two dual-purpose poultry breeds that is known for both its meat and egg production capabilities and known to be present in Ethiopia .

2.2. Breeds Selection Criteria

How do you identify the best egg laying breeds of chicken for your farm?

2.2.1. Selecting layer breeds

When selecting chicken breeds specifically for egg production, there are several key criteria to consider. Here are the main factors to look for when choosing good layer breeds:

- **Egg Production:** Look for breeds that are known for high egg production rates.
- **Egg Size and Quality:** larger eggs and good shell quality and desired yolk color.
- **Persistence of Lay:** Choose breeds that are known for their continuous egg-laying capacity.
- **Feed Efficiency:** efficiency in converting the feed they consume into eggs.
- **Longevity:** Evaluate the breed's lifespan and productive years.
- **Adaptability:** Choose breeds that are known to thrive in your region's climate.
- **Disease Resistance:** Look for breeds resistant or tolerance to common diseases,
- **Availability and Market Demand:** Assess the availability of the breed in your area and the demand for its eggs.

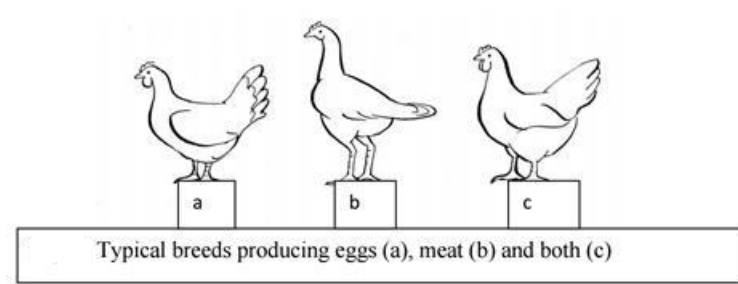


Figure 2. Typical physical appearance of breeds producing egg, meat and both

Practical activity-3	Select the best performing poultry breeds
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A. Resources required

- Weighing scales
- Yolk color fan
- Performance records or data

B. Best performing breed selection procedure**1. Evaluate Breed Performance:**

- Look for performance records or data on egg production, feed efficiency, and other relevant parameters for the different layer breeds you are considering.

2. Consider Market Demand:

- Assess the market demand for eggs in your area.
- Consider factors such as consumer preferences.
- Based on your breed performance, market demand, and cost analysis, create a shortlist of layer chicken breeds that are most suitable for your requirements.





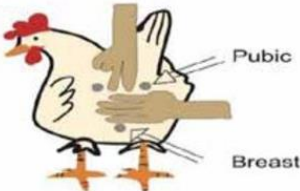
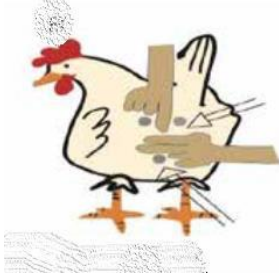
Self-check question -4	Written Test
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1. List two main factors to look for when choosing good layer breeds

Identifying characteristics of good and poor laying chicken

It is necessary to identify poor layers and remove them from the farm. This process is popularly referred to as "Judging" or "Culling" of layers. This is undertaken at 26 to 28 weeks of age when most of the birds are expected to have started laying. There are many more detailed characteristics for hens in production and should be fully observed before selection. Characteristics of good and poor layer chicken are indicated below:

Table 10. Characteristics of good and poor layer chicken

Features	Good layer	Poor layer
Comb color, eye ring, earlobe and beak color	 <p>Soft, enlarged comb and wattles;</p>	 <p>Yellow color in the eye ring, earlobe and beak.</p>
skin around the vent.		 <p>Wide, moist vent; yellow skin around the vent</p>
Distance between the pubic bones and breast the pubic bones and breast	 <p>Increased distance between the pubic bones and breast</p>	 <p>Smaller distance between the pubic bones and breast</p>

Abdominal skin thickness	 <p>Thin skin in the abdominal area</p>	 <p>Thick skin in the abdominal area</p>
Shan color	 <p>Bleached shank color</p>	 <p>Yellow shank</p>

Practical activity-4	Identifying good and poor layer chicken
-----------------------------	--

A. Resources required

- Flock of layer type chicken/local chicken

B. Procedure

- Visit a layer farm/Select a sample of 3 chicken from a laying unit.
- Identify a bird and handle it properly as described
- Observe for the condition of comb, eyes, vent, distance between two pubic bones, distance between tip of the breastbone and pubic bones and molting pattern.
- Note down your observation.
- Give your opinion about the type of the layer bird you observed (whether a good layer or poor layer or a non-layer) based on the judging characteristics given in the previous section (Table 10).

C. Observations

- i. Comb
- ii. Eyes
- iii. Vent
- iv. Distance between tip of the breastbone and pubic bones

D. Results

The given bird is a..... layer.

The given bird..... (should or should not) be culled from the flock.

2.2.2. Selecting broiler breeds

To select the best meat type chicken, consider the following factors:

- Growth Rate: Look for chicken breeds known for their fast growth rates.
- Feed Efficiency: Consider breeds that have good feed conversion ratios, meaning they efficiently convert feed into meat.
- Carcass Yield: Look for breeds that have a high percentage of meat in relation to bone and other non-edible parts.
- Disease Resistance: Choose a breed that is known for its overall health and disease resistance.
- Availability and Accessibility: Consider the availability of the breed in your area.
- Production System: Certain breeds may perform better in specific production systems.
- Market Demand: Consider consumer preferences in your area and the demand for certain breeds or meat qualities.

Self-check question -5	Written Test
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1. List two main factors considered while selecting the best meat type chicken
2. In a few words list the characteristics that you observe in a good layer chicken

Unit Summary

Poultry breed selection is of utmost importance in poultry farming for several reasons. This unit focuses on the identification of the most important local and exotic poultry breeds based on their physical characteristics. This unit also focuses on poultry breed selection, identification, and specifically addresses the process of selecting suitable breeds for different purposes, such as meat production, egg production, or dual-purpose. This unit also addresses methods of identifying good and poor laying chicken.

Unit Review Questions

Please select the correct answer from the options provided.

1. Which of the following is true about Ethiopian indigenous chickens?
 - A. They are known for their high eggproduction.
 - B. They are primarily bred for meat production.
 - C. They are resistant to common poultry diseases
 - D. They have a fast growth rate.
2. What is the definition of a rooster chicken?
 - A. Female chicken.
 - B. A young chicken.
 - C. A male chicken.
 - D. A chicken raised for meat production.
3. Which of the following is not an exotic chicken breed?
 - A. Rhode Island Red
 - B. Plymouth Rock
 - C. Sussex
 - D. Horro
4. Which of the following is not a meat type breed?
 - A. Orpington
 - B. Cornish
 - C. Jersey black giant
 - D. Rhodes Iceland red

5. Which of the following is true about the performance of commercial hybrid chicken breeds?
- A. They have a slower growth rate compared to traditional breeds.
 - B. They are less efficient in converting feed into meat or eggs.
 - C. They are known for their high growth rate and feed conversion efficiency.
 - D. They have a lower egg production rate compared to traditional breeds.
6. Which of the following is not a common criterion used in layer breed selection?
- A. Egg size and quality.
 - B. Feed efficiency.
 - C. Market demand for poultry products.
 - D. Growth rate.
7. Which of the following is a characteristic of a good layer?
- A. Yellow color in the eye ring, ear lobe and beak
 - B. Yellow skin around the vent.
 - C. Increased distance between the pelvic bones.
 - D. Thick skin in the abdominal area

Project Work

LAP TEST 2	Identify and select poultry breeds
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Time started: _____ Time finished: _____

Instructions: Visit one model poultry farm in the nearby area and given necessary templates, tools and materials you are required to perform the following tasks within **6** hours. Every student is expected to undertake the project individually.

Task-2. Perform poultry breed selection either for meat or egg production based on the selection criteria

Answer key for self-check questions

Self-check question 3

Number	Answers
1	Leghorn
2	Rhode Island Red and Potchefstroom Koekoek

Self-check question 4

Number	Answers
1	Egg production, egg size and quality, persistency of lay, feed efficiency, longevity, adaptability, disease resistance, availability and market demand.

Self-check question 5

Number	Answers
1	Growth rate, feed efficiency, carcass yield, disease resistance, availability and acceptability, production system and market demand.
2	Soft and enlarged combs, increased distance between pubic bones, thin skin in abdominal area and bleached shank color.

UNIT 3

Poultry House Construction and Facilities

Learning Outcome

At the end of this unit, the students will be able to:-

- Select appropriate site for poultry house construction
- Identify different types of poultry housing systems
- Understand the requirements for poultry house construction
- Identify poultry house facilities

Key terms

- Poultry house
- Deep litter
- Cage system
- Brooder house
- Grower house

Unit Introduction

The construction of a poultry house involves several key considerations. The location of the poultry house should be chosen carefully, taking into account factors such as drainage, accessibility, and proximity to potential sources of contamination. The design and construction of the house should incorporate features that facilitate proper ventilation, insulation, lighting, and ease of cleaning.

3.1. Site Selection

Why is shelter and protection important for poultry in a poultry house?

There are many reasons why poultry should have a well-constructed house

- To protect them from floods, rain and the sun
- To protect them from predators - dogs, cats, snakes, birds of prey, rats and thieves
- To prevent mice, rats and other birds from eating their feed and transmitting Disease
- To give hens a safe place to lay their eggs

Selecting the appropriate site for a poultry house is crucial for the success of your poultry farming operation. Here are the steps involved in poultry house site selection:

- **Accessibility and Infrastructure:** Ensure that the site is easily reachable for deliveries of feed, water, and other supplies.
- **Topography and Drainage:** Assess the natural drainage characteristics of the site to ensure that it is well-drained and does not have a history of flooding or waterlogging.
- **Distance from Residential Areas:** Consider the distance between the poultry house site and nearby residential areas. It should also be away from roads, work areas, and other noisy places to reduce stress caused by disturbances.
- **Biosecurity and Disease Prevention:** Select a site that is isolated from other poultry farms, particularly those with a history of disease outbreaks.

By following these steps and conducting a thorough evaluation, you can select a suitable site for your poultry house that meets your operational needs, complies with regulations, and fosters a conducive environment for the health and productivity of your poultry.

Self-check question -6

Written Test

1. How can accessibility and infrastructure impact the management of a poultry farm?
2. Why is it important to consider the surrounding community (distance from residential areas) when selecting a poultry farm site?

3.2. Types of Poultry House




How do cage systems differ from free range housing systems for poultry?

The type of poultry housing depending on the stage in life and also their purpose are listed below.

- Brooder – this is used to keep layer chicks for 0 to about 8 weeks of age.
- Grower house – Used to house layer chicks from 9 to 18 weeks of age.
- Brooder Grower house – Used to house layers from 0 to 18 weeks of age.
- Layer house – Used to house layers from 18 weeks to 72 weeks.
- Broiler house – Used to house broilers up to 6 weeks of age

In Ethiopia, various types of poultry houses are used to accommodate poultry farming operations. These types can vary depending on the scale of the operation, available resources, and local climate conditions. Here are some common types of poultry houses in Ethiopia:

Table 11. Common types of poultry houses in Ethiopia

<p>Traditional Backyard Houses: These houses are typically small, simple structures made of locally available materials such as wood, bamboo, thatch, or mud</p>	
<p>Deep-Litter Houses: Deep-litter houses are commonly used in Ethiopia. These houses utilize a bed of litter material, such as straw, wood shavings, or crop residues, on the floor.</p>	
<p>Raised Slatted Floors: These houses have elevated floors with slatted or perforated platforms that allow droppings to fall through. This design helps keep the birds clean and reduces direct contact with droppings, improving hygiene and disease control.</p>	

Cage Systems: These systems consist of stacked cages in which the birds are housed. The cages provide a controlled environment and facilitate efficient management, feeding, and egg collection. Layer chicken are suitable for cage system.



Practical activity-5

Identifying types of poultry house

A. Resources required

- Cardboard
- Paper
- Popsicle sticks

B. Poultry house type identification procedure

- Visits to local poultry farms that employ different types of housing systems.
- Observe and document the features of each poultry house, such as structure, size, ventilation, and layout.
- Use materials (cardboard, paper, popsicle sticks) and construct miniature models of various poultry housing systems.
- Present your models to the class, explaining the key features of each type.

Self-check question -7

Written Test

1. Brooder house is used to keep layer chicks for _____ to _____ weeks of age.
2. What types of poultry are suitable for cage systems?

3.3. Requirements for Poultry House Construction

What are the essential structural components and materials needed for a poultry house, including walls, roofing, flooring, and supports?

When constructing a poultry house, there are several key requirements that should be considered to ensure a safe and productive environment for the birds. Here are some important requirements for poultry house construction:

- Should be located in non-residential areas
- Should be located near the consumer area
- Should be located in a place where transportation facilities are available (water, electricity, feed and equipment are to be within the reach of the poultry farm)
- The materials used should be durable and resistant to deterioration.
- Should provide sufficient space for the number of birds being housed.
- Should have appropriate feeding and watering systems that ensure easy access to feed and water for the birds.
- The flooring should be easy to clean, non-slip, and resistant to moisture and corrosion.
- Must be elevated from the ground so that water may not get in to the poultry house during the rainy season
- Proper temperature and proper ventilation need to be maintained

Table 12. Standard stocking densities and environment requirements for layer and broiler chicken.

	Layer	Broiler
Stocking density for deep litter system	7 birds / m ²	16.5 birds / m ² (33 kg/m ²)
Drinkers		
Bell drinkers	100 birds / Hanging bell drinker	75 birds / Hanging bell drinker
Nipple	10 birds / nipple	10-12 birds/ nipple

Feeders		
Per feeding pan	25 birds / round feeder - pan	50-70 birds / round feeder - pan
Linear chain	minimum 10 cm / bird	2.5 - 4 cm/bird.
Nest boxes	5-6 birds per nest / 120 birds per 1m ² of collective nest	-
Perches	10 cm of perch / hen (distance 40 cm from each other)	-

A good commercial poultry house should have the following components (Figure 3):

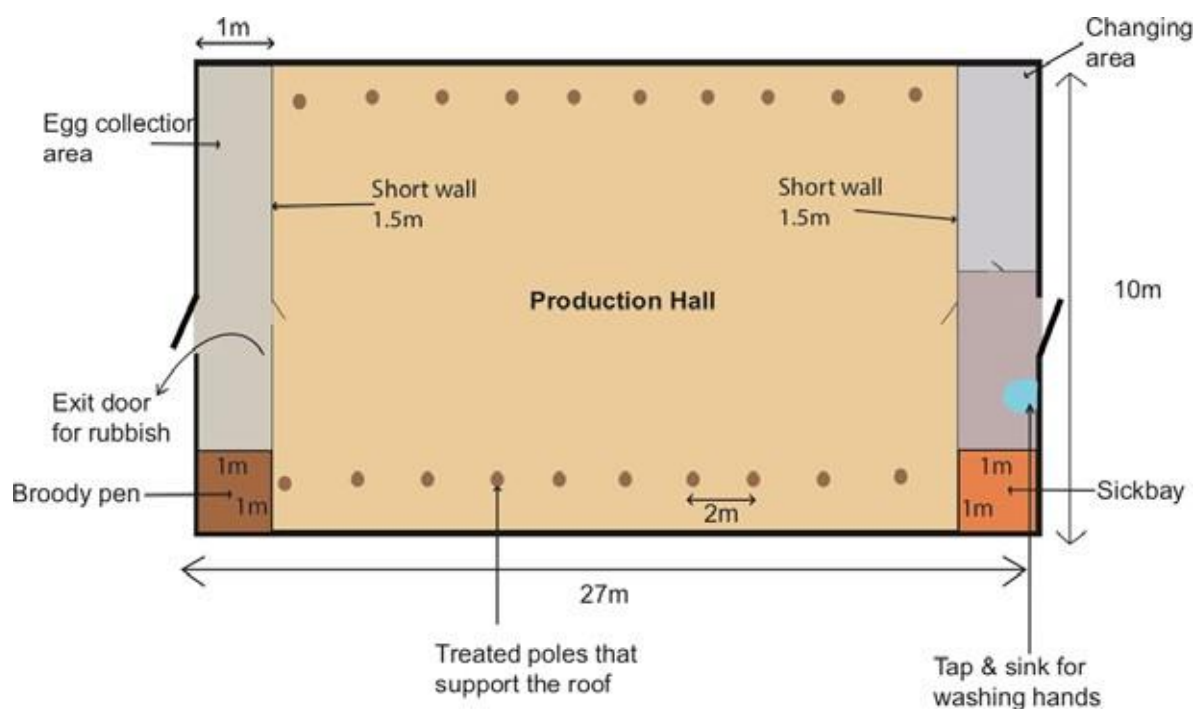


Figure 3: Ground plan for a commercial poultry

- a) Production hall
- b) Changing area
- c) Egg collection/feed holding unit
- d) Entry (clean) and exit (dirty) doors
- e) Sink and water taps with detergents
- f) An isolation unit

An open sided commercial poultry house for 1,750 layers should be 10m x 25m (27m) (250 m²; 7 birds per m²) and for 4125 broilers should be 10m x 25m (250 m²; 16.5 birds per m²). The length of the entire house is 27m, however the effective length is 25m because of the space deducted for the work area in front (1m) and behind (1m). See Figure 4 and 5.

The open sided design is meant to take care of the following:

- a) Maximum comfort for the birds.
- b) Convenience for poultry attendants.
- c) Ease of disinfection
- d) Simple and cheap to construct.

The construction of workers quarter must be outside the perimeter fence in order to avoid biosecurity threat of diseases coming from the quarter and people who visit them.

The following should be considered during construction:

Roof: Construct using timber/poles/metal bars and iron sheets. The roof should provide sufficient overhang (1.5 m) to prevent rainwater from entering into the building during the windy weather. On top of the roof, one side should over-hand the other to form a ventilation duct. The duct should be covered with welded and chicken wire mesh to prevent wild birds from entering the poultry house.

Walls: the long side walls should be 1m high (brick or plain sheet). The space between the wall and the roof should be covered with welded/chicken wire mesh on a frame of treated wooded poles and timber. The gables made of either bricks or plain sheet from the floor to the roof and a double leaf door on both sides.

The difference in design between a broiler and layer house is determined by ventilation and light needs of the two. While the short wall of the layers' house is 1 m high, the one for the broiler is half a meter, but with a second overhang or tarpaulin to avoid harsh weathers like storm.

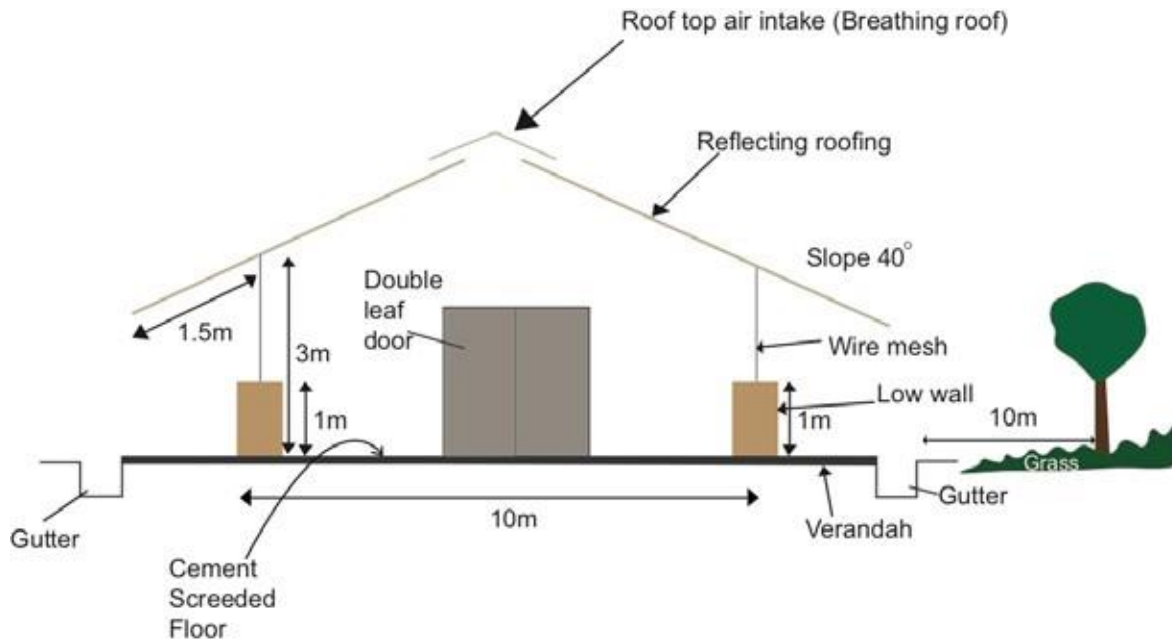


Figure 4: A cross-section of a layer commercial open-sided house

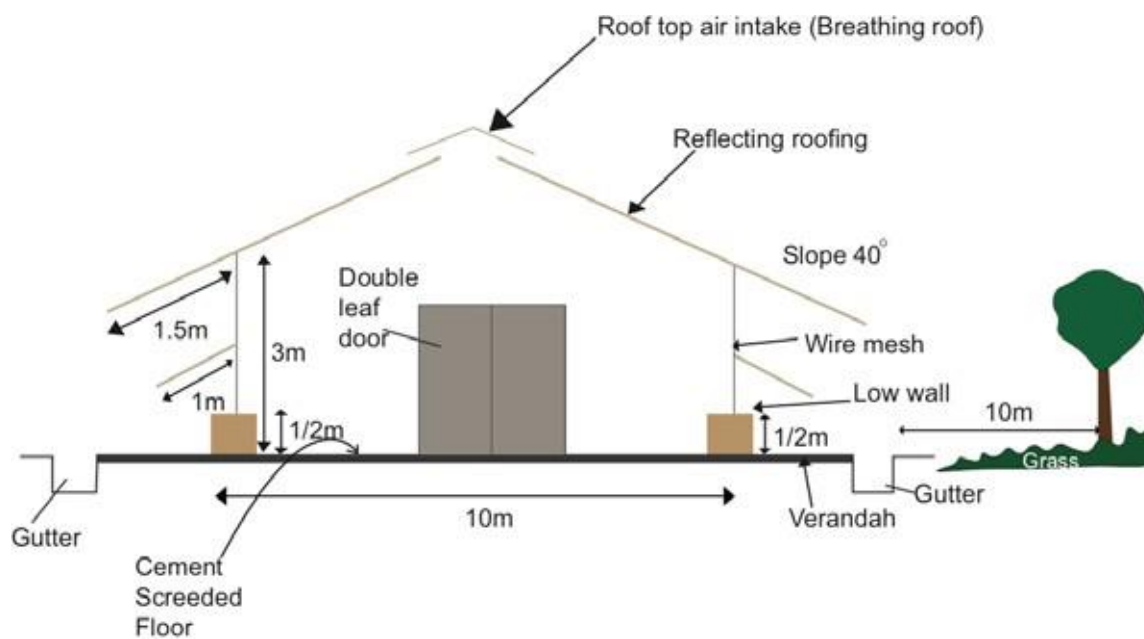


Figure 5: A cross-section of a commercial broiler open-sided house

Practical activity-6	Identify the requirements for poultry house construction
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A. Resources required

- Lumber for framing the structure.
- Metal sheets for walls and roofing.
- Concrete for the base floor.
- Air inlets or louvers for controlled fresh air intake.
- Electrical wiring and switches.
- Lighting fixtures, such as LED lights or fluorescent tubes.
- Water pipes, fittings, and valves for the water supply system.
- Water troughs for providing water to the birds.
- Feeding troughs for storing and dispensing feed.
- Fasteners such as nails.
- Safety equipment, including gloves, goggles, and helmets.

B. Procedure for poultry house construction

- Determine the type and size of poultry house based on the intended purpose (broilers, layers, etc.) And the number of birds to be housed.
- Consider factors such as site selection, orientation, access to utilities, and compliance with local regulations and building codes.
- Develop a detailed layout plan including dimensions, room allocation, ventilation, feeding and watering systems, and other necessary infrastructure.
- Clear the construction site of any vegetation, debris, or obstacles.
- Level the ground and ensure proper drainage to prevent waterlogging.
- Prepare the foundation according to the design specifications, which may involve pouring concrete footings or constructing a raised platform.

- Erect the main framework of the poultry house, using suitable materials such as wood or steel.
- Conduct walls, roofing, and doors according to the design plan.
- Install lighting system, put watering troughs in place
- Set up the water supply system, including pipes, valves, and watering equipment.
- Install proper ventilation systems
- Prepare and pour the flooring (bedding) material
- Install feeding and watering equipment, such as feeders, drinkers, and feed storage bins.
- Install footbaths on the gate the house and compound.

Self-check question -8	Written Test
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1. one of the most important requirements for poultry house construction is that the poultryhouse should be located away from residential areas (True/False)
2. How many birds (layers) can be stocked in a chicken house with total floor area of 1400 m² in a deep litter system?


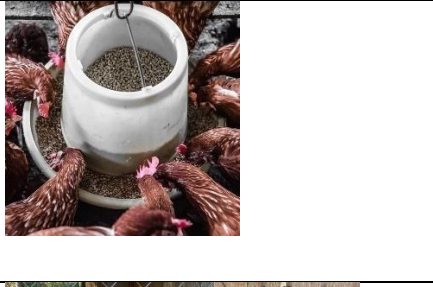

Can you list down some examples of poultry housing facilities?

3.4. Poultry House Facilities

When constructing a poultry house, various facilities are required to support the health, welfare, and productivity of the birds. Here are some essential facilities commonly found in poultry houses:

Table 13. Essential facilities commonly found in poultry houses

<p>Nesting Areas: Nesting areas are provided in poultry houses for egg-laying birds, such as layers. These areas should be designed with comfortable and clean nest boxes or platforms where the birds can lay their eggs.</p>	
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<p>Perches: Perches are necessary for poultry, especially for certain breeds of chickens. They provide elevated resting areas for the birds to perch and roost. Perches should be designed with appropriate dimensions and materials that are comfortable and easy to clean.</p>	
<p>Feeders: Poultry houses should have feeding systems that provide easy access to feed for the birds. Feeders can be in the form of troughs, pans, or automated feeding systems. The design should minimize feed wastage and contamination.</p>	
<p>Waterers: Adequate water supply is essential for the birds' hydration and overall health. Poultry houses should have appropriate waterers, such as troughs, nipples, or cups, that provide clean and easily accessible water. Waterers should be designed to prevent spillage and contamination.</p>	
<p>Lighting Systems: Proper lighting is crucial for poultry production. Poultry houses should be equipped with lighting systems that provide the right level and duration of light for the birds. This may include fluorescent or LED lights that are evenly distributed throughout the house.</p>	

Practical activity-7	Identify poultry housing facilities
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A. Resources required

- Checklist or Worksheet
- Personal Protective Equipment (PPE)
- Documentation Tools

- Measurement Tools
- Lighting Tools
- Camera or Smartphone
- Reference Materials
- Marking or Labeling Materials

B. Procedure

- Review any available blueprints, plans, or diagrams of the poultry house to understand the layout and key components.
- Begin by examining the exterior of the poultry house. Look for features such as the main entrance, windows, ventilation openings, and overall structural integrity.
- Inspect the roofing material and its condition. Check for any leaks, damage, or signs of wear and tear.
- Evaluate the construction material, insulation, and integrity of the walls. Look for cracks, gaps, or signs of pest infestation.
- Determine the type of flooring present, such as concrete, compacted gravel, or specialized flooring. Assess its condition, cleanliness, and durability.
- Identify the ventilation systems, including fans, air inlets, and exhausts. Assess their functionality, cleanliness, and adequacy for providing proper air circulation.
- Identify the lighting fixtures and their placement within the poultry house. Check if the lighting is sufficient and properly distributed throughout the facility.
- Locate the feeders, drinkers, and any automated feeding or watering systems. Assess their condition, cleanliness, and functionality.
- Determine if there are any heating or cooling systems in place, such as heaters, evaporative coolers, or air conditioners. Inspect their condition and assess their effectiveness.
- Identify the nesting areas for layers, if applicable. Assess the design, cleanliness, and accessibility of the nests.
- Determine the presence of waste management systems, such as manure pits, composting areas, or waste removal equipment. Assess their condition and efficiency.
- Identify safety features, including fire extinguishers, emergency exits, and proper signage. Ensure that safety measures are in place and easily accessible.

Self-check question -9	Written Test
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1. List the different types of poultry housing facilities?
2. _____ are provided in poultry houses for egg-laying birds such as layers where the birds can lay their eggs.

Unit Summary

The unit on planning poultry house construction and facilities provides an overview of the key considerations and steps involved in designing and constructing a poultry house. It covers the various aspects of planning, site selection, design, and equipment requirements to ensure a well- designed and functional facility for poultry production.

The unit discusses the critical factors to consider during site selection, including access to utilities, topography, drainage, biosecurity, and proximity to markets or processing facilities. It emphasizes the significance of choosing a suitable location that meets regulatory requirements and optimizes operational efficiency.

Thu unit also discusses about the different types of poultry house with brief descriptions. The unit then delves into the design considerations for poultry houses, covering aspects such as building materials, ventilation systems, lighting, insulation, flooring, and space requirements. It emphasizes the importance of providing adequate space for birds, maintaining proper airflow, and ensuring a comfortable environment that promotes optimal growth and health.

Biosecurity measures are also discussed in the unit, emphasizing the need for strict protocols to prevent disease introduction and spread. It covers topics such as controlled access, cleaning and disinfection procedures, and separation of production zones to minimize disease risks and maintain flock health.

Unit Review Questions

Part I Choose the correct answer from the following alternative letters

1. What is the first step in the poultry house site selection process?
 - A. Determining the flock size
 - B. Assessing the availability of utilities
 - C. Accessibility and Infrastructure
 - D. Evaluating access to markets
2. Which factors are typically considered when assessing the environmental suitability of a poultry house site?
 - A. Drainage
 - B. Proximity to water sources
 - C. Prevailing wind direction
 - D. All of the above
3. Why is it important to evaluate the accessibility of the site during poultry house site selection?
 - A. To ensure efficient transportation of feed and supplies
 - B. To facilitate easy delivery of poultry products to the market
 - C. To comply with biosecurity measures
 - D. All of the above
4. What does the term "topography" refer to in the context of poultry house site selection?
 - A. The natural drainage characteristics
 - B. The prevailing climate patterns in the area
 - C. The availability of suitable labor force
 - D. The zoning regulations and land use restriction
5. What does the term "biosecurity" mean in relation to poultry house site selection?
 - A. The measures taken to protect poultry from diseases and pests
 - B. The availability of veterinary services in the area
 - C. The proximity to other poultry farms
 - D. All

-
6. The reason behind constructing a poultry house is?
 - A. To protect the birds from flooding
 - B. To protect the birds from predators
 - C. A and B
 - D. None
 7. The facility which is used to keep chicken from 9 to 18 weeks of age is called?
 - A. Layer house.
 - B. Broiler house
 - C. Brooder house
 - D. Grower house
 8. A method of poultry bedding management where a thick layer of organic material, such as straw, wood shavings, or sawdust, is spread on the floor of a poultry house.
 - A. Cage system
 - B. Deep litter
 - C. Slatted floor
 - D. Poultry house
 9. Layer house is used to house layers from
 - A. 0-6 weeks
 - B. 0-18 weeks
 - C. 9-18 weeks
 - D. 18-72 weeks

10. Which type of poultry house utilizes stacked wire cages to house individual birds?
- Deep-litter house
 - Battery cage house
 - Tunnel-ventilated house
 - Environmental control house
11. Which type of poultry house is generally a simple structure made of locally available materials such as wood, bamboo, thatch, or mud?
- Battery cage house
 - Traditional backyard house
 - Tunnel-ventilated house
 - Conventional house

Part II Matching

	A		B
12.	Waste Management	A	Provides a comfortable and secluded space for hens to lay their eggs.
13.	Egg Collection Systems	B	7 birds / m ²
14.	Feeder	C	Stores and dispenses feed for the poultry.
15.	Perch	D	16.5 birds / m ²
16.	Heating	E	Maintains the optimum temperature within the poultry house.
17.	Nesting Area	F	Manages and disposes of waste materials generated by the birds.
18.	Waterer	G	Facilitates the collection of eggs in a convenient and efficient manner.
19.	Ventilation	H	Offers a raised structure or platform for birds to rest or

			sleep.
20.	Stocking density of layers for deep litter system	I	Facilitates the removal of excess heat, moisture, and gases from the poultry house, maintaining air quality and bird health.
		J	Supplies clean water for the birds' hydration.

Project Work

LAP TEST 3	Perform poultry house construction
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Name..... ID..... Date.....

Time started: _____ Time finished: _____

Instructions: Visit one model poultry farm in the nearby area and given necessary templates, tools and materials you are required to perform the following tasks within **6** hours. Every student is expected to undertake the project individually.

Task-1. Perform site selection for poultry house construction

Task-2. Perform sketches of a simple poultry house for keeping about 250 broiler chickens or 120 laying hens on the floor (deep litter system)

Answer key for self-check questions

Self-check question 6

Number	Answers
1	It facilitates the deliveries of feed, water, and other supplies.
2	To reduce stress on birds caused by disturbances.

Self-check question 7

Number	Answers
1	From 0 to about 8 weeks of age.
2	Layer chicken

Self-check question 8

Number	Answers
1	True
2	200

Self-check question 9

Number	Answers
1	Nesting area, perches, feeders, waterers lighting system <i>etc.</i>
2	Nesting areas

UNIT 4

Poultry Management

Learning Outcome

At the end of this unit, the students will be able to:-

- Identify types and sources of poultry feeds
- Formulate ration for different classes of chicken
- Undertake routine poultry management activities

Key terms

- Brooding
- Candling
- Concentrate
- Green feed

Unit Introduction

Feeding takes about 65-70% of the whole production cost in broiler and layer production. Therefore, adequate feeding along with other management practices is very essential for maintenance of good flock health and productivity. Poultry feed rations are usually formulated to contain all the nutrients that are essential for their proper body functioning. Deficiency of any of these essential nutrients may result in some form of abnormalities and often disease conditions arise because of lack of certain ingredients in the feed. For maximum efficiency, all the nutrients required by the chickens must be supplied in a sufficient quantity.

4.1. Poultry Feeding Management

Do you know how commercial poultry feeds are formulated?

4.1.1. Types of poultry feed

A. Broiler chicken feed

Broiler chicken feeds are specifically formulated to meet the nutritional requirements of meat-producing chickens during their growth and development. The common types of broiler chicken feed are Starter Feed (0 to 4 weeks of age), Grower Feed (4 to 6 weeks of age) and Finisher Feed (6 to 8 weeks of age).

B. Layer chicken feed


Layer chicken feeds are specifically formulated to meet the nutritional requirements of laying hens to support optimal egg production and overall health. Here are the common types of layer chicken feed. The common types of broiler chicken feed are **Starter Feed** (0 to 6 weeks of age), **Grower Feed** (6 to 16 weeks of age) and **Layer Feed** (16 weeks of age onward).


4.1.2. Sources of poultry feed

Poultry feeds can be sourced from various ingredients and suppliers. Here are some common sources of poultry feed:

Table 14. Common sources of poultry feed

1. Concentrates: are less bulky (< 18% CF) feeds containing high amounts of energy and protein.

Energy concentrates: - are feeds rich in energy and are low in digestible crude protein (<20%CP). The common examples include cereal grains such as wheat, maize, barley, sorghum, etc., and cereal by-products.	Protein concentrates: these are concentrates very rich in digestible crude protein (>20% CP). These groups include	
	A. Plant origin protein concentrates.	B. Animal origin protein concentrates.
	<ul style="list-style-type: none"> ✓ Oil containing seeds such as cottonseed, rapeseed, linseed, nougseed, etc. ✓ By products of oil meals such as Peanut meal, Cotton seed meal (cake), Linseed meal, Soybean meal and Noug seed meal. 	<ul style="list-style-type: none"> ✓ They are obtained from meat processing industries, animal slaughter houses and household slaughtering of animals. ✓ These groups include Meat meal, Meat and bone meal, Fish meal, Blood meal
2. Green feeds:		
<ul style="list-style-type: none"> ✓ These are important sources of vitamins. ✓ It is recommended to provide these feeds to the animals especially poultry as they are in their early maturity. ✓ These feeds include legumes like alfalfa and different grass species. ✓ Green feeds also assist the digestibility of other feeds as girt. 		

3. Scavenging: ✓ This is common to poultry that feed on open field mainly in traditional way of production. ✓ Scavenging feeds include seeds, insects, worms, grazing and etc.	
4. Other miscellaneous groups additives: ✓ They are not nutrients, but added to enhance the quality of the nutrient. Minerals: ✓ limestone and Salt: they are sources of Ca, P, Na, Cl <i>etc.</i>	

Practical activity-8	Identify the different types of poultry feeds
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Here's a practical activity to help identify different types of poultry feed:

A. Resources required

- Small containers or cups for holding the feed samples
- Labels or cards for marking each sample

B. Procedures

- Gather different samples of poultry feeds and ingredients you want to identify.
- Set up a designated area for the activity, preferably a clean and well-lit workspace.
- Place each type of poultry feed or feed ingredients in a separate container or cup. Make sure to label each container with the corresponding feed type.
- Observe and examine the different feed samples. Pay attention to the color, texture, size, and appearance of the feeds.
- Carefully examine each feed/ingredient sample, using your senses of sight, touch, and smell.

Self-check question -10	Written Test
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1. What are some common sources of protein used in poultry feed?
2. Which ingredient is a widely-used source of carbohydrates in poultry feed?

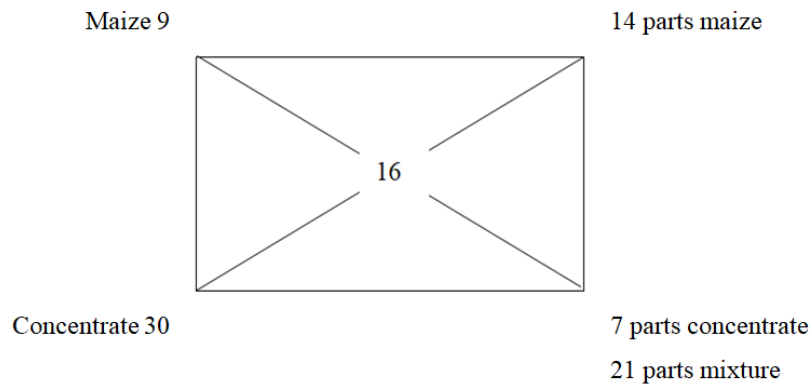
4.2. Ration Formulation for Classes of Chicken

Ration formulation for chickens involves the process of designing a balanced diet that meets the nutritional requirements of the birds at different stages of growth and production. Here are the steps involved in formulating a chicken ration:

4.2.1. Steps in ration formulation for chicken

- **Determine the Nutritional Requirements** based on their age, breed, production purpose (meat or eggs). These requirements include protein, energy, minerals, and amino acids.
- **Identify Available Feed Ingredients** that are locally available and suitable for use in the ration. This may include grains (corn, wheat, barley), protein sources (soybean meal, fish meal), oilseeds (sunflower seeds, canola), and other ingredients such as vitamins, minerals, and feed additives. Consider the quality, cost, and availability of each ingredient.
- **Analyze Nutrient Composition:** Obtain the nutrient composition values (protein, energy, amino acids, minerals, etc.) of the selected feed ingredients from reliable sources like feed composition tables, lab analysis, or nutritional software. This information will help in determining the nutrient contribution of each ingredient to the ration.
- **Formulate the Ration** using specialized software, spreadsheet programs, or manual calculations. Minimum and maximum rate of inclusion of the selected feed ingredients in the poultry ration should be considered.
- **Pearson's Square** Mr. Pearson was an American scientist, who developed a method to combine 2 (never more than two) materials with different concentrations, to obtain a mixture with exactly the concentration to be obtained. Suppose maize (9% CP) and a concentrate (30% CP) are available. How much of each should be mixed in order to obtain a feed with a CP content of 16%. Use "Pearson Square" method (also called "Dairymen's square" or "envelope method").

Answer: Draw a square with its diagonals



Mix 14 parts maize with 7 parts concentrate and the mixture contains 16% cp. The quantities expressed in percentages are:

$$\text{Maize} \quad \frac{14}{21} \times 100 = 66.7\%$$

$$\text{Concentrate} \quad \frac{7}{21} \times 100 = 33.3\%$$

4.2.2. Steps in mixing the ration

Poultry feed mixing involves combining various ingredients in the right proportions to create a nutritionally balanced feed for poultry. Here are the general steps involved in poultry feed mixing:

- Formulate a Feed Recipe (following the procedure indicated in the previous section)
- Gather Ingredients: Collect the required ingredients for the feed formulation. These typically include grains (such as corn, wheat, or barley), protein sources (such as soybean meal or fishmeal), fats or oils, vitamins, minerals, and any additional additives or supplements.
- Grinding and Particle Size Reduction: If necessary, grind or mill the ingredients to reduce particle size and improve digestibility.

- **Weighing and Measuring:** Accurately measure the desired quantities of each ingredient based on the feed formulation.
- **Mixing:** Combine the weighed ingredients in a suitable mixing device, such as a feed mixer or a clean concrete surface.
- **Packaging and Storage:** Pack the finished feed in appropriate containers, such as bags or bulk storage systems. Label the containers with relevant information, including the feed type, date of production, and any specific instructions. Store the feed in a clean, dry, and well-ventilated area to maintain quality and prevent contamination.

Example

Here's an example of a simplified poultry ration formulation for a growing broiler chicken:

Pearson square

1. Determine the Nutritional Requirements:

Let's assume we're formulating a ration for broiler chickens between 3 to 6 weeks of age. The nutritional requirements for this stage may include:

Crude Protein:	20-22%
Metabolizable Energy:	3,000-3,100 kcal/kg
Calcium:	0.9-1.0%
Available Phosphorus:	0.45-0.50%

2. Identify Available Feed Ingredients:

For this example, we'll consider some commonly available feed ingredients:

Corn:	60%
Soybean Meal:	25%
Wheat:	10%

Fish Meal: 3%

Limestone: 1%

Vitamin and Mineral Premix: 1%

3. Analyze Nutrient Composition:

Here are the assumed nutrient compositions of the feed ingredients:

Feed ingredients	Crude protein content (%)	Metabolizable energy content (kcal/kg energy)
Corn:	9	3,200
Soybean Meal:	46	2,800
Wheat:	13	3,000
Fish Meal:	60	4,000
Limestone:	38% calcium	

Vitamin and Mineral Premix: Provides necessary vitamins and minerals

4. Formulate the Ration:

To meet the nutritional requirements, we can formulate the ration as follows:

Table 15. Sample poultry ration

Ingredients	Inclusion level (%)
Corn	65
Soybean Meal	25
Wheat	7

Fish Meal	2
Limestone:	0.8
Vitamin and Mineral Premix	0.2
Total	100

5. Conduct Quality Control:

Ensure that the calculated nutrient levels of the formulated ration match the desired targets. Also, check for any physical considerations like particle size and pellet quality.

Please note that this is a simplified example, and actual ration formulation may involve more complex calculations and considerations. It's crucial to consult with a poultry nutritionist or veterinarian for accurate and specific ration formulation for your flock, taking into account the unique requirements and available ingredients in your region.

Practical activity-9	Formulate ration for chicken
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A. Resources required

- Nutrient requirement table
- Animal feed formulation software like feed Calculator/ Feed win
- Raw materials (locally available feed ingredients and additives)
- Feed mill
- Weighing balance
- Mixer
- Pelletizer (optional)

B. Procedures

- Source locally available and affordable raw materials such as grains (corn, wheat), protein sources (soybean meal, fish meal), and supplements (calcium, vitamins).

- Grind the grains and other coarse ingredients using a simple grinder or hammer mill. Ensure grinding to the right particle size for the different age
- Groups of birds (Chicks, growers, layers, broilers etc.).
- Weigh the individual ingredients using a scale or simple weighing equipment.
- Batch the ingredients according to the feed formulation recipe.
- Mix the weighed ingredients thoroughly. A simple horizontal or vertical mixer can be used for small-scale operations.
- You can also mix the feed manually using shovel on clean cement screened floor
- Ensure uniform distribution of all ingredients to create a well-blended feed.
- Package the finished feed in suitable containers, such as bags or bins.

Self-check question -11

Written Test

1. What is the first step in ration formulation for chicken?
2. What are some common nutrient requirements that need to be met in poultry rations?
3. Suppose we have soybean meal (42% CP) and maize (9% CP). How many kilograms of soybean meal and maize should be mixed to obtain 100 kg of a mixture with a CP content of 26% CP?

4.3. Routine Poultry Management Activities

4.3.1. Egg Management

How long does it take for a chicken egg to hatch?

4.3.1.1. Egg production in the chicken

A well-fed layer hen will begin to produce eggs when she achieves puberty at 4-5 months old, even if she has not been mated. The hen will produce one egg every 26-28 hours, but will not produce eggs in the dark. Normally, the hen will lay a clutch of eggs and become broody.

A hen's egg production is at its height at 8.5 months old. After this age, the egg production begins to decrease. At 18-20 months old, chickens will stop producing eggs and they will moult (lose their

feathers). Egg production is normally highest during the first year of production (240 eggs per year) and then falls each year as the hens get older.

The following describes how an egg is produced in a chicken:

- The yolk of the egg (yellow part of the egg) is produced in the ovary of the hen and released into the reproductive tract.
- The white part of the egg is formed in the oviduct.
- The shell of the egg is formed in the uterus, which is also known as the shell gland.
- Eggs pass through the vagina and are laid through the cloaca.

4.3.1.2. The quality of eggs

Eggs should be kept in a cool place. If placed in a refrigerator, chicken eggs will stay fresh for 3 weeks.

The following points are useful to note:

- An egg produced by a female bird kept without a male is called a non-fertile egg. A non-fertile egg will keep fresh for a long time.
- Eggs from a female that has mated with a male bird are alive (that is, fertilized). The young chick will start to grow if the fertilized egg is kept in a warm place.
- To check if eggs are fertilized, hold them against a light (see more information in the section, Candling). If the egg has been fertilized, the contents of the egg may appear pink in color, or you may be able to see the young chick developing inside the egg.
- Dirty eggs should be cleaned before they are sold or used. Never wash dirty eggs in warm water. Wiping eggs with a damp cloth is also not good practice because germs and dirt can be transferred between eggs on the damp cloth.
- Remove dirt by gently rubbing the dirty areas with fine sandpaper.
- If eggs are placed in a container of cool, clean water, the bad eggs (eggs that cannot be eaten) will float to the top of the water, while the good eggs stay at the bottom.

4.3.1.3. The broody hen

A hen is brooding when she sits on her eggs in a nest to incubate them. Natural incubation is the simplest way to hatch small numbers of eggs. The broody hen can be used to incubate and hatch her own eggs or

those from another bird. A hen can incubate 12-15 chicken eggs. A good test to check the broodiness of the hen is to put some white balls, or a few hardboiled eggs, in its nest for a day or two. If the hen stays in the nest and is not easy to move off, she is a good brooder. You can then replace the balls and hardboiled eggs with 10-15 fertile eggs. The eggs should be checked first to see that they are fertile. The broody hen is kept in a nesting box. Take the hen off the nest for 20 minutes each day to give her feed and water.

4.3.1.4. How to use an incubator (For hatching eggs)

Natural incubation by the female bird is the simplest way of hatching a small number of eggs. To hatch a large number of eggs, an incubator that is heated by kerosene or electricity can be used.

Eggs being hatched in an incubator must be checked to make sure they are developing healthy chicks. The condition of the eggs in the incubator can be checked by candling method

If a community has a small incubator, it should be able to incubate and hatch eggs with good results if the steps below are followed:

1. Run the incubator for a few days to make sure the temperature is steady at 39.5 degree Celsius.
2. Make sure the incubator is level and the temperature of the room where it is kept stays fairly constant and below the temperature of the incubator.
3. Make sure you have enough kerosene to run the incubator for the required length of time or that your electricity supply is reliable.
4. Choose eggs that are not too small, not too large and do not have thin or cracked shells.
5. Only incubate eggs that were laid over the previous 7 days.
6. Candle the eggs before placing them in the incubator to make sure that the eggs have been fertilized.
7. Make sure the thermometer is level with the eggs.
8. Make sure that there is always water in the water tray inside the incubator. This will ensure that the moisture content of the air in the incubator is correct.
9. Do not touch the eggs with a dirty hand or after handling kerosene.
10. Turn the eggs twice a day for the first 18 days and move them around (as the mother bird would do). From day 18, chicken eggs should not be touched and the incubator should not be opened.

4.3.1.5. Candling (checking if eggs are fertilized)

Sometimes, eggs can be incubated but after a lot of care no young hatch because the eggs were not fertile. This can be avoided by checking the eggs before putting them to incubate, and also during their time in the incubator.

You will need a small box with an electric light, torch or other source of light in it. If you hold the egg against the light (or strong sunlight), you will be able to see if it is fertile or not. The fertile egg will look pinkish in color. Later, as the egg is incubated, there will be a dark shadowy area when the embryo is developing properly. As the embryo develops and hatching time approaches, the inside of the egg will appear dark, except the air cell. You will need to candle (check) eggs:

1. Before putting them in the incubator.
2. 4-5 days after putting them in the incubator. Discard eggs that are still clear.
3. 10 days after putting them in the incubator. Discard any that are not well developed by then.
4. On day 18 of the incubation period. Do not open the incubator again between day 18 and hatching if incubating chicken eggs.

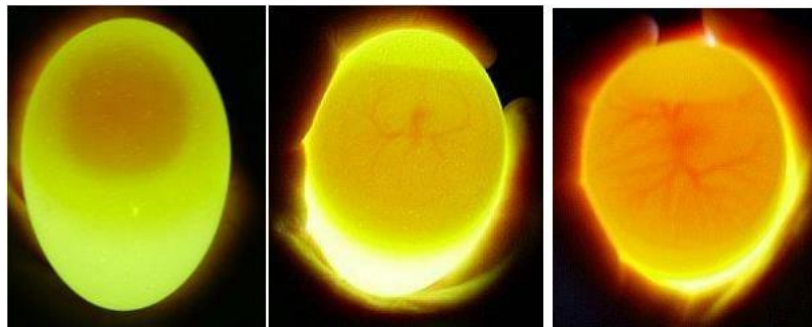


Figure 6. Candling of eggs

Practical activity-10	Perform candling of chicken eggs
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A. Resources required

- Candling device:
- Dark room:
- Eggs:
- Egg tray or carton:

B. Procedure**Prepare the workspace:**

- Choose a dark or dimly lit room to enhance visibility.
- Set up your candling device. If using a flashlight, position it so that the light shines through the bottom of the egg.

Select the eggs:

- Choose eggs that are at least 7 days old, as this is when the embryo starts developing. Ensure the eggs are clean and free from any debris.

Position the eggs:

- Place the egg, one at a time, on the candling device or hold it over the flashlight.
- Hold the egg with the larger end facing upward. This is where the air cell is typically located.

Candle the egg:

- Turn on the candling device or flashlight.
- Position the light source at the larger end of the egg and observe the contents.

Interpret the results:

- Look for the air cell: A clear and well-defined air cell is an indicator of freshness.
- Observe the yolk: A centered and round yolk is ideal.
- Identify the embryo: In fertilized eggs, you may see blood vessels and a developing embryo as a dark mass.

Discard or mark eggs:

- Discard any eggs with abnormalities, such as blood rings, dead embryos, or unusual discolorations.
- Optionally, mark the eggs with the date and any relevant notes for future reference. Repeat the process periodically throughout the incubation period to monitor embryo development.

4.3.2. Brooding management

Brooding refers to the period immediately after hatch when special care and attention must be given to chicks to ensure their health and survival. The importance of the brooding period cannot be over emphasized. The first 14 days of a chick's life sets the precedent for good performance. Extra effort during the brooding phase will be rewarded in the final flock performance.

A good brooder should have the following:

- Optimum Temperature (start 34⁰ C at the end 28⁰ C)
- Good Ventilation (oxygen)
- Optimum light
- Adequate space (30 to 40 birds/m²)
- brooding period' and usually lasts for 3–6 weeks

The accuracy of brooding temperature can be best judged by the movement of the chicks under the brooder. If the chicks are away from the source of light, that is the chicks are in the periphery of brooder, it indicates more temperature. Conversely, if the chicks are in huddling condition under the brooder, it indicates lower temperature. The accurate temperature is indicated by the uniform distribution of the chicks under the brooder.

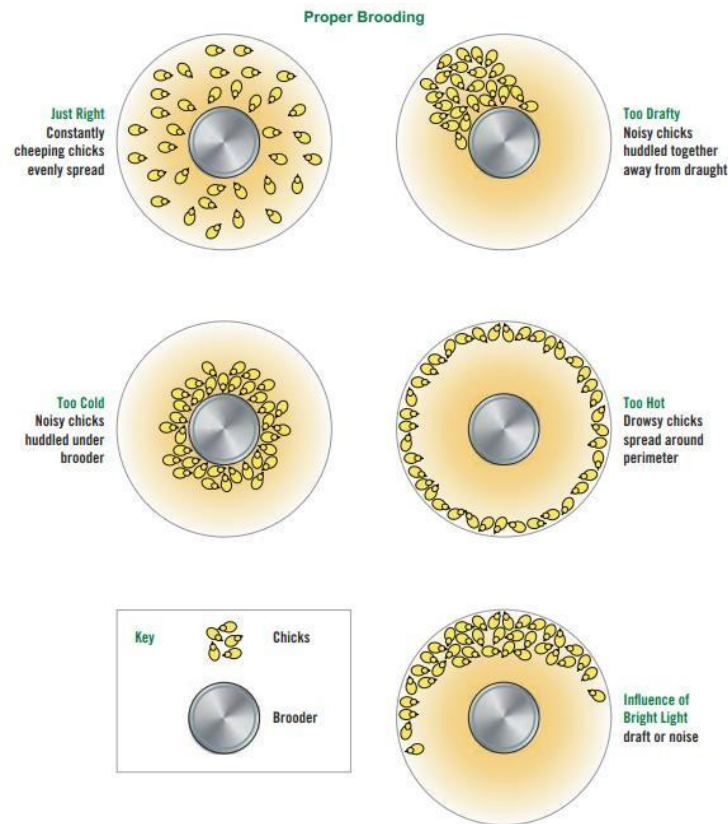


Figure 7. Position of chicks in brooder area

Key points to consider in brooder management

- Get good quality chicks from a reliable source
- Clean out and disinfect the farm before introducing chicks
- Brooding space should be 30-40 birds per square meter
- Use appropriate litter for cushioning the birds and absorbing moisture. For broilers use 5-7cm deep while for layers use a depth of 10-15 cm
- On top of the litter spread clean paper in 3 rows where the drinkers and the initial feed and feeders are placed in order to enable the chicks easily get water and feeds in the first three days of their life
- Use the following lighting program: 1st day 24 hours 2nd day 23 hours and after 7 days 18 hrs.
- Pre heat the house at least 24 to 48 hrs. prior to placement

- High quality thermometer should be suspended just above the litter at key points to effectively record the room temperature.
- Maintain a temperature of 32°C for litter (40.5°C directly under brooders) and the floor temperature 28°C. (27-29°C during week2 and 21-23°C during week 3 and 4)
- Arrange the drinkers and feeders in an orderly manner, alternating the lines of drinkers with the feeders. Provide the following feeder space for the birds when they are growing:
- Provide Quality water
- Guidelines for maintaining the temperature are given in the table below

Chick distribution and behavior should be closely monitored after placement and within the first 24-48 hours of brooding. It is normal to see some chicks sleeping, some chicks eating or drinking, and some chicks actively exploring their new environment. If you observe chicks

panting, huddling, chirping loudly or irregularly distributed within the brood area, investigate the cause(s) immediately. If not corrected, they can have a negative impact on flock welfare and performance outcomes.

Practical activity-11	Perform brooding management
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Resources required

- Brooder house
- Brooder
- Chick Guard
- Disinfectant
- Electrical bulb holder and bulbs of different watts
- Feeder and water trough
- Litter material, paper and day-old chicks

Procedure

- Clean and properly disinfect brooder house
- Cover particular area of the floor of brooder house with litter material about two inches in depth
- Put paper on top of the bedding material further covered with paper.

- Set the brooder on this litter material which is surrounded by the chick guard.
- Fit the required number of bulbs to the brooder and set up electrical connection.
- Arranged the feeder and water troughs inside the chick guard alternatively in such a way that half of the feeder and water trough are placed inside and the remaining half is outside the brooder area.



Figure 8. Preparing a brooding house

- Maintain appropriate initial temperature inside the brooder house and for the subsequent weeks.
- Adjust the temperature inside the brooder by observing the behavior of the chicks.
- Depending on outside temperature, remove the chick guard after 3 to 4 weeks of age and spread the chicks gradually in the whole room with the arrangement of more numbers of feeders and waterers along with litter materials.
- Remove the brooders after two to four weeks depending upon the temperature requirement

4.3.3. Managing commercial layer chicken

- Commercial layer production involves the rearing of commercial layer birds for eggs.
- This process starts from the brooder through egg production and finally to off laying.
- This section covers post brooder management, beak trimming, nutrition, laying nests, lighting program, disease control, routine management and vaccinations.

4.3.3.1. Post brooding phase

After the brooding phase (from one month onwards), layers develop various vices or abnormal behaviors such as:

- Cannibalism,
- Egg eating
- Toe and vent pecking
- Feather pecking

The above vices cause trauma and damage to the birds which reduces their production potentials. These abnormal behaviors in chicken are influenced by stress resulting from poor management. Factors causing the above vices

- Over crowding
- Too much space
- Poor nutrition as result of poor-quality feeds
- Under feeding chicken
- Inadequate nesting materials
- Open nests or laying nests that are not dark enough during oviposition
- Broken eggs due to pilling up
- Infestation with external parasites
- Too much bright light

4.3.3.2. Debeaking (beak trimming)

Debeaking is a process of partial removal of the beak of poultry. It is a good management practice to prevent and control abnormal behaviors like cannibalism, aggressive behaviors and feather pecking in

layer birds. The first debeaking is at 15 days (precision debeaking) and the second debeaking is done at 8-10 weeks of age.

Precaution-

- Add vitamin K to the drinking water to avoid over bleeding.
- Ensure the temperature of the trimming blade is high enough to prevent over bleeding and burning the birds

Practical activity-12	Perform chicken debeaking
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A. Resources required

- Birds of different ages of both sexes
- Electric debeaking instrument (debeaker)

B. Procedures

- Switch on the debeaker.
- Restrain the bird properly so that it cannot shake its head.
- With the index finger, separate the beaks and hold back the tongue.



Figure 9. Debeaking of chicken using electric debeaking instrument

- Cut two third and one third of the beak from the tip up to the nostrils in the upper and lower beak, respectively. Lower beak must be left longer than the upper one so that the bird can scoop the feed/water easily.

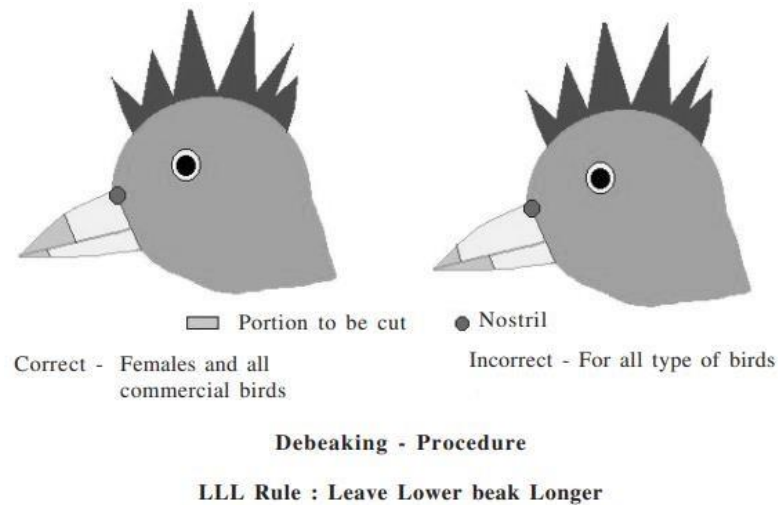


Figure 10. Position to be cut during debeaking

- Burn the beak to stop bleeding (cauterized properly) after debeaking by keeping the cut edge in contact with the blade.
- In case of males, cut both upper and lower beaks equally.

4.3.3.3. Nutrition

By end of week 18 the flock should have attained an average weight of 1450 to 1500g, only then good production with an excellent peak will be guaranteed.

Mature layers consume an average of 125 to 135 gm. of feeds per day and drink up to 300 – 350 mls of water per day depending on the quality of feeds and water as well as the environmental conditions prevailing at that material time.

4.3.3.4. Nest

Nests are specially designed pigeonholes made of wood or galvanized steel, where the laying bird comfortably lays its' eggs. They should be evenly distributed in the laying house and easily accessible at one or two levels, locate the nests in the darker side of the house. Each individual nest is for 5 hens or 1 square meter for 120 hens.

4.3.3.5. Lighting program

Provide a lighting program for growth and production of the layers. In the absence of electricity, kerosene lamps can be used. Light influences the age of sexual maturity and feed consumption. Use the table below for the lighting program.

Table 16. Lighting program for layer chicken

Age (weeks)	
1-2	23 hours for 2-3 days, then 22 hours
3	19 hours
4	18
5	17
6	16
7	14
8-16	Natural day length (12 hours)
17	14 hours (increase by 2 hours)
18	14.5 hours (increase by half hour weekly to 16 hours – week 21)

4.3.3.6. Water

Distribute drinkers evenly throughout the whole house, alternating them with feeders so that they are easily accessible to all birds. The birds should not walk more than 1.5m to get feed or drink. Provide one font for 50 chicks during the first week and gradually replace them with regular drinkers. Wash and disinfect the chick drinkers daily. Fill the drinkers with clean fresh water every day. **Never** allow drinkers to go dry. Below is simple equipment layout for a 500-layer house.

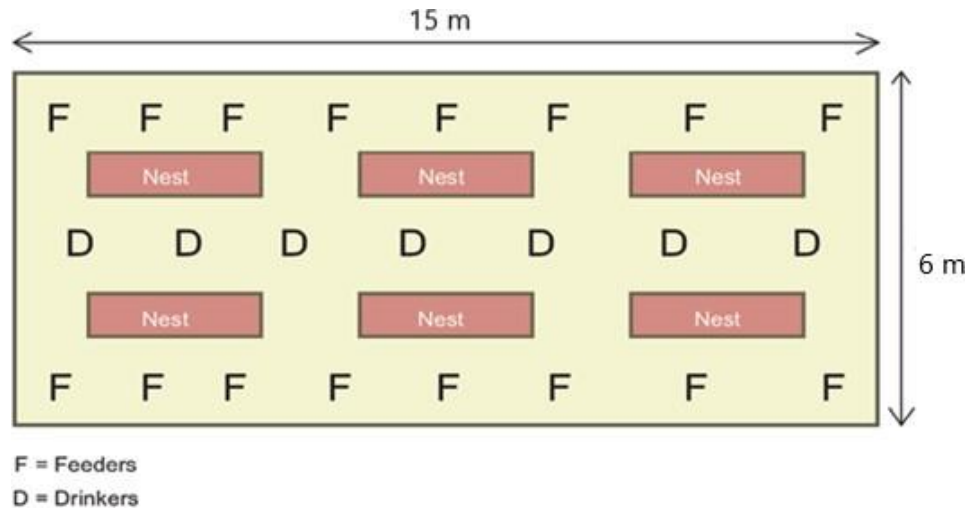


Figure 11. Equipment outlay for a house of 500 layers; 6 nest boxes each with 20 slots on 2 levels@ slots for 5 birds; F = Feeders {16 feeders @ 30birds / feeder} D= Drinkers {7 drinkers @ 13drinkers / 1000 birds}

4.3.4. Managing commercial broiler chicks

Commercial broiler production involves the rearing of broilers to produce meat in the shortest time possible; normally between 5-6 weeks. The process starts from the brooder in the first two weeks then up to 5 – 6 weeks when they are ready for the market. After brooding (2 weeks) increase the space to 25 chicks per square meter and at 5 – 6 weeks give 16.5 birds per square meter.

- Give broiler starter to chicks during the first four weeks of their life, or give broiler starter crumble pellets, for two weeks followed by broiler grower pellets for two weeks.
- Give broiler finisher from four weeks to marketing or finish with broiler finisher pellets from four weeks to marketing.
- Provide fresh water all the time and clean the drinkers every day. Use bell drinkers, improvised drinkers and nipples.
- The litter should be 15cm thick and must be turned every day to avoid caking and molding. Avoid water spillage on the litter.



Figure 12. Commercial broiler production using bell drinkers and plastics bucket feeders

Practical activity-13	Perform rearing, feeding and watering of chicks, growers and layers
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1. Resources required

- Debeaker
- Different types of cages
- Egg collecting basket/filler flat
- Feeding and water trough of different type and capacity
- Laying nest
- Litter materials
- Vaccinator

2. Procedure

- Visit a brooder/grower/layer or broiler farm.
- Perform the routine management activities in the farm like rearing, feeding and watering of chicks, growers and layers.
- Note down your observations.

Observations

Record your observations and remarks with respect to the following at the farm you visited.

- Number of birds along with system of rearing.
- Brooding method.
- Space allowances – floor, feeder and waterer space.
- Litter condition and litter management practices.
- Lighting – arrangement, cleanliness and duration in a layer farm.
- Routine feeding and watering at the farm.
- Dairy Feed allowances for the chicken.
- Number of times eggs collected from laying nests.
- Cleaning and disinfection of equipment – feeders, waterer, brooders, egg filler flats, crates, buildings etc.
- Vaccination – routine vaccination schedule followed in layer farm.
- Mortality and their causes.
- Bio-security measures
- Any other observations: pecking, egg eating etc.

Results

Based on your observations, give your opinion on the above listed issues in the farm your visited.

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Self-check question -12	Written Test
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1. What does brooding means?
2. What is the importance of debeaking?

Unit Summary

This unit covers various aspects of poultry nutrition and management, including types and sources of poultry feed, dietary nutrient requirements, ration formulation, egg management, brooding management, commercial layer management, debeaking, and lighting management for broilers.

The unit begins by introducing the different types of poultry feed, including broiler and layer chicken feeds. It explores the sources of feed ingredients such as grains, protein sources (e.g., soybean meal, fish meal), fats, minerals, and vitamins. It emphasizes the importance of using high-quality feed ingredients to meet the nutritional needs of poultry.

Next, the unit focuses on understanding the dietary nutrient requirements of poultry. It discusses crude protein, metabolizable energy, essential amino acids and minerals. It explains recommended levels necessary for optimal growth, reproduction, and overall health.

Ration formulation is then covered in the unit, highlighting the process of balancing the nutrient composition of poultry feed to meet specific requirements. It discusses the different procedures in ration formulation.

Egg management including egg production in chicken, quality of egg, managing broody hen, how to use incubators and candling of eggs are also addressed in this chapter. Brooding management is another important topic addressed in the unit. It covers aspects such as brooder selection, temperature management, ventilation, bedding, and feeding and watering systems. It emphasizes the critical role of providing a comfortable and controlled environment during the early stages of poultry life for optimal growth and development.

The unit then delves into the management of commercial layers, focusing on aspects such as housing, lighting, temperature, ventilation, feeding and disease prevention. It provides guidelines for maintaining a productive layer flock, optimizing egg production, and ensuring bird welfare. Debeaking, a common management practice in poultry production, is discussed in the unit. It covers the reasons for debeaking, the techniques involved, and the potential benefits and challenges associated with this practice.

Lastly, the unit addresses management for broilers. It explains the significance of proper lighting programs to stimulate growth, improve feed efficiency, and regulate bird behavior. It covers different feeding, watering and health management of broilers.

Unit Review Questions

1. Which of the following is a common source of protein in poultry feed?
 - A. Corn
 - B. Wheat
 - C. Soybean meal
 - D. Oats
2. How are animal by-products utilized in poultry feed formulation?
 - A. As a source of carbohydrates
 - B. As a source of fiber
 - C. As a source of protein
 - D. As a source of vitamins
3. You will need to candle (check) eggs during the following periods except
 - A. 4-5 days after incubation
 - B. 10 days after incubation
 - C. After 18 days of incubation
 - D. None
4. Which of the following is a commonly used tool for poultry ration formulation?
 - A. Spreadsheet software
 - B. Hammer mill
 - C. Feed mixer
 - D. Automatic feeder
5. What is the main objective of formulating poultry rations?
 - A. Maximizing feed intake
 - B. Minimizing feed cost
 - C. Maximizing egg production
 - D. Minimizing waste
6. What is the first step in poultry ration formulation?
 - A. Determining the nutritional requirements of the poultry
 - B. Selecting the feed ingredients
 - C. Analyzing the nutrient content of the ingredients
 - D. Calculating the amount of each ingredient needed

7. What is the purpose of determining the nutritional requirements of the poultry in ration formulation?
 - A. To optimize feed intake
 - B. To maximize growth rate
 - C. To prevent nutritional deficiencies or excesses
 - D. To minimize feed costs
8. What is the first step in mixing poultry ration?
 - A. Weighing the ingredients
 - B. Grinding the ingredients
 - C. Mixing the ingredients
 - D. Packaging the finished ration
9. Which step involves combining the weighed and ground ingredients to achieve a uniform mixture?
 - A. Weighing the ingredients
 - B. Grinding the ingredients
 - C. Mixing the ingredients
 - D. Packaging the finished ration
10. What is the final step in poultry ration mixing?
 - A. Weighing the ingredients
 - B. Grinding the ingredients
 - C. Mixing the ingredients
 - D. Packaging the finished ration
11. What is the ideal brooding temperature for newly hatched chicks?
 - A. 30-35°C
 - B. 20-25°C
 - C. 10-15°C
 - D. 40-45°C
12. What is the typical duration of the brooding period for chickens?
 - A. 2-3 days
 - B. 1-2 week
 - C. -3 weeks
 - D. 3-6 weeks

13. What is the purpose of providing a brooder guard or circle during the initial days of brooding?
- To prevent drafts
 - To provide additional warmth
 - To restrict the movement of chicks
 - To control the humidity level
14. What is the primary reason for debeaking chickens?
- To prevent cannibalism and feather pecking
 - To improve feed efficiency
 - To control disease transmission
 - To enhance egg production
15. What is the most common method used for debeaking chickens?
- Hot blade trimming
 - Cold blade trimming
 - Laser trimming
 - Chemical beak conditioning
16. What is the recommended stocking density for commercial broiler chickens in deep litter system?
- 6 birds per square meter
 - 10 birds per square meter
 - 16 birds per square meter
 - 20 birds per square meter

Project Work

LAP TEST 4	Manage Poultry
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Name..... ID..... Date.....

Time started: _____ Time finished: _____

Instructions: Visit one model poultry farm in the nearby area and given necessary templates, tools and materials you are required to perform the following tasks within **6** hours. Every student is expected to undertake the project individually.

Task-1. Perform preparation of a ration using locally available feed resources based on the procedure

Task-2. Perform candling of chicken eggs.

Task-3. Perform chicken debeaking

Answer key for self-check questions

Self-check question 10

Number	Answers
1	Cottonseed, rapeseed, linseed, nougseed, peanut meal, cotton seed meal (cake), linseed meal, soybean meal, noug seed cake, meat meal, meat and bone meal, fish meal, blood meal
2	Maize, wheat, barley, sorghum, etc., and cereal by-products.

Self-check question 11

Number	Answers
1	Determine the nutritional requirements of chicken
2	Crude protein, metabolizable energy, calcium, available phosphorus <i>etc</i>
3	Soybean meal = 51.5kg and maize = 48.5 kg

Self-check question 12

Number	Answers
1	Brooding refers to the period immediately after hatch when special care and attention must be given to chicks to ensure their health and survival.
2	Debeaking is used to prevent and control abnormal behaviors like cannibalism, aggressive behaviors and feather pecking in layer birds

UNIT 5

Management of Common Poultry Diseases

Learning outcome

At the end of this unit, the students will be able to: -

- Identify common poultry diseases
- Implement routine vaccination program
- Apply poultry farm bio-security activities

Key term

- Disease
- Vaccination
- Biosecurity

Unit Introduction

The unit on managing poultry disease training provides participants with essential knowledge and skills to effectively identify, prevent, and control diseases in poultry. This training unit typically covers various aspects related to poultry disease management.

In common terms, a disease is an abnormal condition that is caused by infection or environmental stress. A disease is defined by a specific group of signs or symptoms. Diseases prevent affected animals from functioning normally. Health is the overall condition of an animal at a given time. Disease causes this condition to weaken. This can result in poor productivity and reduced quality of the affected animals. It could even lead to the death/loss of one or all of the birds in a flock. Diseases can be categorized by common causes, such as genetic, mechanical, toxic, and nutritional. Infectious diseases are caused by viruses, bacteria, and fungi. Parasitic diseases are caused by protozoa, worms, and external parasites such as mites and lice.

Infectious agents, commonly referred to as “germs,” move from one susceptible bird to another in order to survive. For this to occur in a flock, a sufficient number of disease-causing agents must be able to gain access to the susceptible birds. These are birds that have no immunity or other resistance against these agents or whose defense mechanisms have been reduced or overwhelmed at the time of infection.

Poultry health is very important because it determines the ability of the farmer to provide good quality poultry products, byproducts and hence income. It has also been greatly affected in this era of high incidences of anti-microbial resistance coupled with high aflatoxin contamination of feeds, which affects man.

Signs of a good health for chicken

- Be active
- Feed normally
- Have normal droppings
- Make normal sounds and movements
- Drink optimum water
- Have clear open nostrils with no discharge
- Have clear and shiny eyes without discharge, no swellings around the eyes and eyelids

- Carry wings close to the body
- Have clean vent area without sores

Signs of poor health for chicken

- Have normal feathers without large missing patches
- Breathe with a closed mouth except in very hot conditions,
- There may be one or a combination of the following
- The birds appear dull with sleepy eyes
- Drooping wings
- Ruffled feathers
- Loss of appetite
- Diarrhea (white, yellow, green, red, colorless)
- Strange sounds and actions
- Loss of weight.
- Coughing.
- Swellings on the head and/or feet.
- Drop in egg production.
- Abnormal shell quality.
- Sudden deaths

5.1. Common Poultry Diseases




5.1.1. Major poultry diseases in Ethiopia




What is the difference between prevention and treatment of disease?

Poultry diseases can vary in prevalence and impact depending on the region and specific conditions in Ethiopia. Some of the common poultry diseases encountered in Ethiopia include:

A. Viral disease

Table 17. Viral diseases of chicken

Newcastle disease			
Cause	Symptoms	Transmission	Prevention/control
Can cause 100% mortality in an unprotected flock.	<p>Mild form - nasal discharge, coughing</p> <p>Severe one -high mortality, twisting of the head</p> 	Through the feces, air, chicken carcasses, feed, water, footwear, clothing, equipment and litter.	<p>vaccination program</p> 
Infectious bursal disease (IBD) or Gumboro			
Difficult to eradicate	<p>Listless and depressed, become pale and often huddle together.</p> 	Via droppings, infected clothing and equipment.	<p>No treatment</p> <p>Vaccination</p>

Marek's disease				
Herpesvirus	Gray eyes and blindness, lameness,paralysis, unthriftiness. 	Via feather dander, dust, feces and saliva.	no treatment for marek's disease. Vaccination at hatchery.	
Fowl pox				
slowly spreading viral disease affecting chickens.	Raised scab-like lesions on unfeathered areas, reduced production 	Air-borne, the bite of insects	No treatment Vaccination in endemicareas.	
Avian influenza				
can be transmitted to humans	Respiratory distress, diarrhea, swollenhead		Via feces	no treatment


B. Bacterial diseases

Table 18. Bacterial diseases of chicken

Cause	Symptoms	Transmission	Prevention/control
Infectious coryza			
It is a common problem in some parts of Ethiopia.	Swelling of the head and wattles, nasal discharge, rattles, egg production drop and diarrhea.	Direct contact, and via contaminated Feed and water.	Sanitation and biosecurity

C. Parasitic diseases

Table 19. Parasitic diseases of chicken

Cause	Symptoms	Transmission	Prevention/control
Coccidiosis/Eimeria			
<i>Eimeria spp.</i> , widely distributed in Ethiopia.	Diarrhea or dysentery, reduced food and water intake, weight loss and visibly depressed birds. 	Via the fecal-oral route.	Good litter management, coccidiostats (ionophoric antimicrobials)

5.1.2. General disease control measures

- Provision of a comfortable, safe, disease-free environment for the birds since
- Prevention is better than curell.

- Culling/isolation of infested birds
- Proper vaccination program
- Good nutrition
- Farm fumigation
- Rodent and Insect control
- Good water quality
- Proper burying of dead birds
- Sourcing of chicks from a reputable hatchery
- Training of farm staff on principle of farm biosecurity
- Proper litter management
- Consult a qualified veterinary doctor

Practical activity-14	Identification of health and sick birds
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A. Requirements

- A flock of chicken in deep litter system

B. Procedure

- Wear preferably dress meant for the purpose - cleaned and disinfected; it is a good practice to have a disinfectant spray;
- Disinfect your footwear by dipping in the foot-bath .
- Have gloves, mask and a cap
- Carry sterile vials, disposable syringe, catching hook, specimen bottle, polythene bags, slides etc., for collection of any material for further examination.
- Note the type, age and number of birds along with system of rearing.

General Observations

- Do not disturb the flock. Observe for birds seeking corners, looking dull sleeping while standing and showing abnormal postures.

- Give a gentle clap or whistle. In a healthy flock, all the birds show alert attention toward the sound. If it is feeding time, they show rapid movements towards feeders and make typical sound while expecting feed. Therefore, the best time to notice the changes is the feedingtime.
- Observe for the colour of the droppings. Abnormal colour of the droppings such as black, chalky white, green, red, yellowish white etc., are suggestive of different disease conditions.
- Observe for the consistency of the droppings. Loose or dry consistency of the droppings indicates unhealthy or disease condition.
- Observe for the posture of the birds. Abnormal postures such as backward movements, lameness (difficulty in walking), one leg forward and the other backward, paralysis, sitting on hock joints, twisting of neck, etc., suggests a disease problem.
- Listen for any abnormal sounds by the birds. Abnormal sounds like gurgling (broken, irregular, bubbling sound) or chirping (short, high-pitched sound, such as that made by a small bird or insect) sounds indicates unhealthy condition.
- Look out for abnormal behavior like cannibalism (eating other birds), pecking (fighting), etc.
- Observe for positioning of feeders and drinkers, especially the latter to check for spillage and wetting of litter. Also assess the floor, feeder and drinker space allocation.
- Record any other observation which you consider abnormal; for instance, drinkers being dry, eggs lying on litter, egg shells seen on litter etc.

Individual Examination

- Catch the sick bird (preferably by hand) by holding the wings gently; sick birds do not run away as fast as the healthy ones; if needed, use a catching hook. However, heavy birds like breeders are better caught by their wings.
- Restrain the bird by holding both wings at the base, and observe different parts of the body for any abnormalities. Note that all the sick birds need not show all the following changes.

C. Observations

Note down the condition of the following parts of a bird examined by you.

a) Head.....

b) Eyes.....

- c) Comb and Wattles.....
- d) Beak.....
- e) Nose.....
- f) Mouth.....
- g) Feathers.....
- h) Skin.....
- i) Neck.....
- j) Wings.....
- k) Legs.....
- l) Vent.....

Self-check question -13	Written Test
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1. What will you do to stop your chickens from getting sick? Make a short statement.
2. One of the following is a sign of poor health
 - A. Active birds
 - B. Drooping wings
 - C. Loss of appetite
 - D. Coughing

1.2. Routine Vaccination Program

In Ethiopia, vaccination plays a crucial role in preventing and controlling poultry diseases. Vaccination programs can vary depending on the region, farm type (commercial or backyard), and the specific needs of the flock. Here are some common vaccines used for chickens in Ethiopia:

Table 20. Suggested vaccination and medication schedule for broilers production within a cycle of 6 weeks (42 days)

Age (Day/weeks)	Activities	Route	Remarks
Day 1 (week 1)	Lasota	Eye drop/spray/oral	To be given at hatchery
Day 1- 5	Antibiotic + Multivitamin	Water	
Day 7	Gumboro	Via drinking water	
Day 8-9	Multivitamin	Via drinking water	
Day 10	Lasota	Via drinking water	
Day 10 – 13	Multivitamin	Via drinking water	
Day 14	Gumboro	Via drinking water	
Day 15 – 18	Multivitamin	Via drinking water	
Day 21	Gumboro	Via drinking water	
Day 22 – 25	Multivitamin	Via drinking water	

Table 21. Suggested vaccination and medication schedule for layer production within a cycle of 70 to 90 days.

Type of vaccine	Age of bird	Route of administration
Marek's vaccine	Day 1	Subcutaneous
Newcastle disease HB1 vaccine	Day 3	Eye drop
Gumboro vaccine	Day 7 and 21	Eye drop/water
LaSota Newcastle disease vaccine	At day 27, 63, 112 and every 3 months	Eye drop/water

Fowl typhoid vaccine	At 6 and 12 weeks of age	Subcutaneous
Fowl pox vaccine	From day 70-90	Wing web

Source: DZARC, vaccination schedule

5.3. Poultry Farm Bio-security Activities

Biosecurity (biological security) is securing the environment from biological agents and is the best form of defense against emergency diseases on poultry farms. This means preventing the entry of disease-causing organisms into a farm. Some Biosecurity measures in Poultry Production

- Source disease-free chicks
- Build shelters against wind and rain
- Clean houses regularly and apply disinfectant timely.
- Provide dry litter regularly/Good litter management
- Do not put too many birds in a pen/overstocking
- Different species of poultry, for example hens, turkeys, pigeons, ducks and guinea fowls should be kept separate
- Separate chicks from adult birds, establish an –All in, all out rule
- Vaccinate against diseases and re-vaccinate if necessary.
- Regulate visitor's entry the farm
- Control wild birds, rodents, and reptiles
- Avoid visiting neighbor's farm and returning to your own without a complete change of footwear and clothing.
- Practice sanitary clean-up and waiting period (2-weeks minimum) before
- Introducing a new flock to used pens. Exposure to direct sunlight kills many germs.
- Give access to the right feed (free from aflatoxin) and clean water always.
- Remove dead birds immediately and get rid of them by burning or deep burial.
- Ensure disinfectant is in the foot dip and at the entrance of farm.

Unit Summary

This unit focuses on common poultry diseases, signs of poor health, disease control measures, routine vaccination programs, and poultry biosecurity.

The unit begins by discussing common poultry diseases, including viral, bacterial, and parasitic infections. It covers diseases such as Newcastle disease, avian influenza, coccidiosis, infectious bronchitis, and Marek's disease. Each disease is described in terms of its causative agents, transmission routes, clinical signs, and potential impact on poultry health and production.

Signs of poor health in poultry are then explored. The unit highlights various indicators that can suggest a bird's compromised health, such as reduced appetite, weight loss, decreased activity, abnormal feces, respiratory distress, feather abnormalities, and decreased egg production. Understanding these signs is crucial for early detection and prompt intervention.

The unit emphasizes disease control measures as a critical aspect of poultry health management. It covers biosecurity practices. It also discusses the importance of proper waste management, maintaining clean and dry housing conditions, and implementing effective vaccination programs.

Routine vaccination programs are addressed in the unit, emphasizing their role in preventing and controlling common poultry diseases. It covers the important vaccines based on disease prevalence and bird age. The unit also discusses the methods of vaccine administration, such as subcutaneous or intramuscular injection, drinking water application, or spray vaccination.

Poultry biosecurity is a significant focus of the unit. It highlights the importance of biosecurity measures in preventing disease introduction and spread. It covers concepts such as controlled access, isolation of new birds, proper cleaning and disinfection practices, and the use of personal protective equipment.

Unit Review Questions

1. Which of the following is a sign of good health in poultry?
 - A. Active and alert behavior
 - B. Coughing or sneezing
 - C. Watery or discolored droppings
 - D. Weight loss and decreased appetite
2. Gumboro Disease is another name for which poultry disease?
 - A. Newcastle Disease
 - B. Infectious Bronchitis
 - C. Infectious Bursal Disease
 - D. Avian Influenza
3. Which one of the following is a bacterial disease in chickens?
 - A. Newcastle Disease
 - B. Avian Influenza
 - C. Infectious Bursal Disease
 - D. Fowl Cholera
4. Which of the following diseases is caused by a protozoan parasite and affects the intestinal tract of chickens?
 - A. Avian Influenza
 - B. Newcastle Disease
 - C. Infectious Bursal Disease
 - D. Coccidiosis
5. Which of the following is a general disease control measure for chickens?
 - A. Vaccination
 - B. Providing extra heat lamps
 - C. Increasing feed intake
 - D. Allowing free-ranging in contaminated areas

6. What is the simplest method of vaccine administration in chickens?
 - A. Intramuscular injection
 - B. Oral administration
 - C. Subcutaneous injection
 - D. Eye drop application

7. Which of the following is a biosecurity measure for disease prevention in poultry?
 - A. Allowing wild birds access to the poultry farm
 - B. Sharing equipment between different poultry farms
 - C. Implementing visitor restrictions and controlled entry
 - D. Keeping feed and water sources uncovered and exposed

Project Work

LAP TEST 5	Perform identification of sick birds
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Name..... ID..... Date.....

Time started:_____Time finished: _____

Instructions: Visit one model poultry farm in the nearby area and given necessary templates, tools and materials you are required to perform the following tasks within **6** hours. Every student is expected to undertake the project individually.

Task-1. Perform identification of sick birds in the farm.

Answer key for self-check questions

B. Answer key for self-check questions

Self-check question 1

Number	Answers
1	A
2	True

Self-check question 2

Number	Answers
1	Chicken tray feeders, automatic chick feeder and hanging type plastic feeder.
2	Bell type automatic waterer, nipple drinkers and manual drinker or fountain drinkers

Self-check question 3

Number	Answers
1	Leghorn
2	Rhode Island Red and Potchefstroom Koekoek

Self-check question 4

Number	Answers
1	Egg production, egg size and quality, persistency of lay, feed efficiency, longevity, adaptability, disease resistance, availability and market demand.

Self-check question 5

Number	Answers
1	Growth rate, feed efficiency, carcass yield, disease resistance, availability and acceptability, production system and market demand.
2	Soft and enlarged combs, increased distance between pubic bones, thin skin in abdominal area and bleached shank color.

Self-check question 6

Number	Answers
1	It facilitates the deliveries of feed, water, and other supplies.
2	To reduce stress on birds caused by disturbances.

Self-check question 7

Number	Answers
1	From 0 to about 8 weeks of age.
2	Layer chicken

Self-check question 8

Number	Answers
1	True
2	200

Self-check question 9

Number	Answers
1	Nesting area, perches, feeders, waterers lighting system <i>etc.</i>
2	Nesting areas

Self-check question 10

Number	Answers
1	Cottonseed, rapeseed, linseed, noug seed, peanut meal, cotton seed meal (cake), linseed meal, soybean meal, noug seed cake, meat meal, meat and bone meal, fish meal, blood meal
2	Maize, wheat, barley, sorghum, etc., and cereal by-products.

Self-check question 11

Number	Answers
1	Determine the nutritional requirements of chicken
2	Crude protein, metabolizable energy, calcium, available phosphorus <i>etc</i>

Self-check question 12

Number	Answers
1	Brooding refers to the period immediately after hatch when special care and attention must be given to chicks to ensure their health and survival.
2	Debeaking is used to prevent and control abnormal behaviors like cannibalism, aggressive behaviors and feather pecking in layer birds

Self-check question 13

Number	Answers
1	Apply the general disease control measures like culling, isolation, vaccination <i>etc</i>
2	A

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