Dairy Production
Level-III

Learning Guide 29

Unit of Competence: **Conserve forage**

Module Title: **Conserving forage**

LG Code: **AGR DRP3 M08 0120 LO1- LG-29**

TTLM Code: **AGR DRP3 TTLM 1219 v1**

LO -1: Prepare for forage conservation

Instruction Sheet	Learning Guide -29

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

- Determining forage conservation options from the production plan.
- Identifying risk factors for spoilage in forage conservation.
- Confirming the suitability of *paddock* conditions for forage production.
- Preparing forage conservation machinery and equipment
- Ensuring clear access to paddocks for harvesting and transport machinery.
- Preparing storage facility

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

- Determine forage conservation options from the production plan.
- Identify risk factors for spoilage in forage conservation.
- Confirm the suitability of *paddock* conditions for forage production.
- Prepare forage conservation machinery and equipment
- Ensure clear access to paddocks for harvesting and transport machinery.
- Prepare storage facility

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2 and Sheet 3”.
4. Accomplish the “Self-check 1, Self-check 2,and Self-check 3” **in page -3, 7,9, 13, 15 and 18** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1,” **in page -21.**
6. Do the “LAP test” **in page – 22** (if you are ready).

Information Sheet-1	Determining forage conservation options from the production plan

1.1. Introduction of forage conservation

In most parts of the world, forage conservation is a key element for productive and efficient ruminant livestock farms. Forage conservation permits a better supply of quality feed when forage production is low or dormant. Forage conservation also provides farmers with a means of preserving forage when production is faster than can be adequately utilized by grazing animals.

This prevents lush growth from becoming too mature. Consequently, forage conservation provides a more uniform level of high quality forage for ruminant livestock throughout the year. Forage is preserved as either hay or silage. In hay production, the crop is dried so that it is essentially biologically inactive both with respect to plant enzyme activity and microbial spoilage. The low moisture content also permits easier transportation by reducing the weight per unit of dry matter (DM).

Although several methods have been proven as efficient ways to store and preserve forages, it is important, to keep this fact in mind: At best, conserved forages can rarely match the nutritive value of fresh forage because some losses of highly digestible nutrients (sugar, protein, and fat) are unavoidable during conservation and storage. Our goal in forage conservation is to focus on minimizing losses, which start immediately after cutting.

Forages can be conserved to feed livestock during periods of shortage caused by limited pasture growth or inadequate pasture conditions, or fed as a supplement. Conserved forages can take the form of hay, haylage, and silage. Although several methods have been proven as efficient ways to store and preserve forages, it is important, to keep this fact in mind: *At best, conserved forages can rarely match the nutritive value of fresh forage because some losses of highly digestible nutrients (sugar,*

protein, and fat) are unavoidable during conservation and storage. Our goal in forage conservation is to focus on minimizing losses, which start immediately after cutting.

When selecting a conservation method, a producer should consider the suitability of the forage for a given method, storage capability, weather conditions, and the intended use of the conserved forage. The selected conservation technique should maximize nutrient conservation efficiency and minimize production costs.

When selecting a conservation method, a producer should consider:-

- The suitability of the forage for a given method
- Storage capability
- Weather conditions
- The intended use of the conserved forage.

The selected conservation technique should maximize nutrient conservation efficiency and minimize production costs.

Self-Check -1	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (5 pts each)

1. Explain the importance conserving forage.
2. Explain how forage can be conserved.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

_____

_____

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2._____

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Information sheet 2	Identifying risk factors for spoilage in forage conservation

Spoilage is the process in which food or other substances stop being good enough to eat or use, or the waste produced in this process.

Mycotoxins are secondary metabolites produced by fungi of various genera when they grow on agricultural products before or after harvest or during transportation or storage. Only some molds produce mycotoxins, and they are referred to as toxigenic. The fungal toxins are chemically diverse representing a variety of chemical families and range in molecular weight from about 200 to 500. There are hundreds of mycotoxins known, but few have been extensively researched, and even fewer have good methods of analysis available. Some fungi such as Fusarium spp. typically infest grains before harvest, others such as Penicillium spp. can invade grain after harvest, while Aspergillus spp. can grow on grains both before and after harvest. It must be emphasized that the presence of the fungi does not necessarily imply that mycotoxins can be found.

Conversely, the absence of fungi does not necessarily mean the absence of mycotoxins. Both intrinsic and extrinsic factors influence fungal growth and mycotoxin production on a given substrate.

The intrinsic factors include:

- Water activity
- PH, and redox potential

Whereas extrinsic factors which influence mycotoxin production are:

- Relative humidity
- Temperature
- Availability of oxygen.

Mycotoxins are regularly found in feed ingredients such as maize, sorghum grain, barley, wheat, rice meal, cottonseed meal, groundnuts and other legumes. Most are

relatively stable compounds and are not destroyed by processing of feed and may even be concentrated in screenings. Different animal species metabolize mycotoxins in different ways.

Figure 2.1. Common mycotoxin-producing molds in forage

Mycotoxins and possible effects:

- **PR toxin:** Intestinal irritation; abortion; reduced fertility; degenerative effects on liver and kidneys; carcinogenic
- **Patulin:** Immune suppression; inhibition of rumen microbiota; reduced rumen fermentation; cytotoxicity
- **Roquefortine C:** Weak neurotoxicity; abortion; retained placenta
- **Mycophenolic acid:** Immune suppression, mild cytotoxicity (enhanced negative effects on intestinal cells when co-occurring with Roquefortine C)

Aspergillus fumigatus

White mycelium with cream to bluish-grey to dark brown when producing spores, some types remain white

The major occurence is in corn, grass and grain silage.

Figure 2.3. Aspergillus fumigatus

Figure 2.4 Penicillium spp.

Spoilage in the stack or bale is particularly dangerous, and can lead to the loss of the entire harvest, usually as a result of storing material which is at too high a moisture content in over-large units or poorly designed stacks which allow rain penetration or do not allow some ventilation. The ideal moisture content for stacking or baling depends on the crop and the site, and experience and field judgment must be the general guide. The farmer must judge by feel and make a decision in the light of the prevailing weather: when the herbage feels crisp in the hand and does not show moisture when twisted, it is probably at 25 - 30% moisture and ready to bale.

Moisture meters are neither generally available nor convenient to use in the field, and taking a representative sample is not easy. Fine-leaved, thin-stemmed herbage dries most quickly; large coarse grasses with thick stems and nodes (e.g., Sudan grass) can still have a lot of juice in the stems after the leaves are quite dry.

In extreme cases, the fermentation may raise temperatures to levels where spontaneous combustion occurs. Poorly cured or moldy hay, apart from losses, will lead to poor intake or refusal by stock, and may contain mycotoxins. Moldy hay gives rise to the human disease known as "farmers' lung."

Self-Check -2	Written Test

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

PART I. Choice the correct answer (3pts each)

1. Except one the others are an extrinsic factors influence fungal growth and mycotoxin production on a given substrate forage is

   A. Relative humidity B. Temperature C. Availability of oxygen D.All

2. Except one the others are possible effects Mycotoxins PR toxin

A. Intestinal irritation B. Abortion C. Reduced fertility D. Degenerative effects on liver and kidneys E. All

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1. _____

2. _____

Information Sheet 3	Confirming the suitability of paddock conditions for forage production

1.1. Introduction of paddock

Unrestricted grazing of cattle is the way in Ethiopia like many other developing countries. Cattle roam and graze freely destroying farms and farmlands. Their activities also pollute drinking water sources , Degrading natural resources in many areas across the country. Resistance to this has resulted in conflicts between nomads and other farmers who are the victims.

1.2. The Problem with the Nomadic Cattle Herding

Pasture lands are gradually becoming narrow due to the expanding population and developments. The herdsmen resort to the farmlands and their water sources for the survival of their cattle herd. We also believe, in some situations, that these nomadic reluctant to change their nomadic way of life.

Cattle rearing, like many agricultural ventures, is a business and must be handled as such. It requires good investment and management to give good returns.

The creation of a rotational or paddock grazing system is one of the solutions that will help cattle rearers to keep a healthy stock fed and watered without destroying crops of other farmers.

What is Rotational or Paddock Grazing?

Rotational or paddock grazing generally means dividing the pasture into sub-pastures called paddocks. The cattle are moved between pastures as and when needed. This allows a cattle producer to better manage forage in a pasture for a long term. However, it requires more labour.

1.3. Designing a Paddock Grazing System

The basic components of a grazing system include: Landscape, Forage, livestock, water and Fence.

Self-Check -3	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (5pts each)

1. Explain the components of paddock designing for grazing system

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

2. _____

3. _____

Information sheet 4	Preparing forage conservation machinery and equipment

4.1. Pre-harvest preparations

I. Silo maintenance. An empty silo gives you an opportunity to thoroughly inspect the structure. Before each harvest, clean out all old feed and inspect the inside surfaces of each silo. Silage acids can erode concrete or unprotected metal and can cause severe silo deterioration when seepage occurs. Patch any cracks or holes to keep the walls, floor, and roof air and water-tight. Concrete can be coated with plastic, epoxy, or latex masonry paint to extend its life. Also, clean and open drains to allow silage effluent to move away from silage. Check the integrity of door seals, ladders, and cages on upright silos, and inspect the unloader bearings, drive machinery, and cables.

Lubricate and adjust un loaders according to the manufacturer's recommendations. This is also a good time to look at the silo's structural integrity, because older silos can be a hazard if they are not maintained properly. Some silos that look fine may actually be ready to collapse. All silos over 10 years old should be checked periodically by a trained professional. A quick inspection may save lives and thousands of dollars in lost feed and damaged property.

I. **Service all equipment.** Few things are more frustrating than watching crops mature while waiting for replacement parts. Proper maintenance and planning can help you avoid such delays. Before each harvest, all equipment should be serviced and tested to be sure it functions correctly. Change filters and oil and lubricate all the necessary places, following the manufacturer's recommendations.

Also inspect hydraulic hoses and fittings; replace any that are leaking, stiff, cracked, or have a soft or blistered cover. Replace any worn gears, belts, chains, bushings, and sprockets, and order replacement or spare parts. Sharpen and replace knives as needed; dull knives and worn parts increase operating costs and harvester power

requirements, 40 percent of which are for the cutter head. Properly adjusting the number of knives and the feed roll to cutter head speed ratio improves the quality and accuracy of the cut and avoids tearing forage. Dull knives also tend to tear plant cells, which can increase seepage. Check the cutter bar surface to be sure it is sharpened, not rounded.

4.2. Harvesting implements

4.2.1. Machinery

Specialized dairy or beef industries use mechanical harvesters, which are tractor-mounted and driven by a power-take-off shaft. There are two types of such harvesters: the reciprocating blade mower (line mower), and the rotary slasher blade mower. The latter seems durable and efficient, especially for harvesting natural pasture from rough surface.

4.2.2. Hand tools

Machinery, even small-scale, is generally beyond the economic capacity of the subsistence farmer. The most widely (almost universally) used hand tool for harvesting grain and pasture is the sickle. While the sickle is more commonly used, the scythe is a more efficient hand tool for harvesting forage, cereal crops, and slashing weeds.

4.3. Occupational Health and Safety (OHS)

According to the International Labor Organization (ILO), health hazards in working environments are categorized as accidental, physical, chemical, and biological. Here are just a few examples for each category mentioned by this organization

Physical

- Exposure to high levels of noise.
- Long-time exposure to heat and cold.
- Skeletal problems resulting from lifting and moving of animals, feed bins (bags), Heavy materials while preparing land for forage development

Chemical

- Respiratory problems resulting from exposure to dust, which is composed of residue of chemicals, dander, micro-organisms, etc.
- Respiratory, skin, and eye diseases due to exposure to gaseous chemicals.(e.g. NH3, H2S, CO2, CO, and CH4.
- Exposure to disinfectants, detergents, formaldehyde and pesticides.

Biological

- These include infective agents such as viruses, bacteria, fungi and other soil born microbes as well as endotoxins

Self-Check -4	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (3pts each)

1. Define machinery, equipment's and tools in forage harvesting.
2. Explain the OHS related with forage harvesting

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1. _____

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2. _____

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Information Sheet 5	Ensuring clear access to paddocks for harvesting and transport machinery

Forage harvesters can be implements attached to a tractor, or they can be self-propelled units. In either configuration, they have either a drum (cutterhead) or a flywheel with a number of knives fixed to it that chops and blows the silage out a chute of the harvester into a wagon that is either connected to the harvester or to another vehicle driving alongside. Most larger machines also have paddle accelerators to increase material speed and improve unloading characteristics. Once a wagon is filled up, the wagon can be detached and taken back to a silo for unloading, and another wagon can be attached. Because corn and grass require different types of cutting equipment, there are different heads for each type of silage, and these heads can be connected and disconnected from the harvester.

Grass silage is usually cut prior to harvesting to allow it to wilt, before being harvested from swathes with a collection header (windrow pickup). Maize and whole crop silage are cut directly by the header, using reciprocating knives, disc mowers or large saw-like blades. Kernel processors (KP), modules consisting of two mill rolls with teeth pressed together by powerful springs, are frequently used when harvesting cereal crops like corn and sorghum to crack the kernels of these plant heads. Kernel processors are installed between the cutterhead and accelerator. In most forage harvesters, the KP can be quickly removed and replaced with a grass chute for chopping non-cereal crops.

While towed harvesters continue to be used by small family farms, the more efficient way of silage making is with a self-propelled machine with a tractor or truck running along with the forager

Small family farms still used towed behind harvesters, these are either single chop, double chop or precision chop. Older machines were operated by cables, then they were operated by hydraulics and the newer types are operated by electronics.

Self-Check -5	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (6pts each)

1. What is the importance of attaching harvester to the tractor.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1. _____
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2. _____
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Information Sheet 6	Preparing storage facility

Accessibility and traffic flow Grain and commodity receival and storage facilities will need all weather access for varying sizes of grain and commodity transport vehicles. The receival and storage areas should be easily accessible and not affect the flow of operational traffic around the feedlot during placement and removal.

Hay/straw storage areas should be located close to the feed processing facility/commodity shed, but at sufficient distance to minimize damage to infrastructure in the event the forage catches fire. Grain and commodity transport vehicles require sufficient area for maneuvering and loading/unloading. The grain and commodity receival and storage facilities should not be isolated from the feedlot during periods of severe wet weather or flooding.

Proximity to production pens Locating the feed preparation and commodity storage facilities near the production pens will reduce travel distances and minimize the cost.

The following points are the preconditions considered before the preparation of storage facilities

1. **Topography and drainage**

The feed preparation and storage areas (e.g. silage pits) should be well drained and within the controlled drainage area of the feedlot. Storage sites should be located well away from gullies or other places where storm water run-off can flow into feed preparation and storage areas. Storm water run-off should be diverted away from feed preparation and storage structures. This may require additional earthworks and/or control structures (e.g. culverts) at the time of site preparation

2. **Security and biosecurity**

Visitor access to feed preparation and storage facilities should be restricted to reduce interference with feedlot operations, enhance safety and minimize the risk of product contamination. Good biosecurity management will minimize feed contamination and the introduction and spread of noxious weeds.

3. **Above or below ground constraints**

Above or below ground constraints should be avoided. Above ground constraints include overhead power lines and trees. Below ground constraints include underground services, such as power, gas, water and telephone infrastructure.

4. **Building separation and expansion**

Space should be left for potential future expansion of the feed preparation and storage facility. As hay/straw has a low bulk density and is a significant component of some feedlot diets, this should be stored near the feed processing area. However, a compromise between efficiency and safety requires a space of at least 15m between storage of this material and other buildings due to the potential risk of spontaneous combustion.

5. **Groundwater and surface water protection**

The feed preparation and commodity storage facilities should be situated so that the risk of groundwater and surface water contamination is minimal. Some parts of the facilities, such as silage pits and liquid commodity storages, may need to be situated within the controlled drainage area of the feedlot.

Provision for future expansion

Adequate room should be allowed for expansion and flexibility in the commodity storage and feed preparation facility design. Any plan based only on current needs will be difficult and expensive to expand. The rule of thumb is to undertake projections for feedlot needs out by five years and then double this. This leaves room for future expansion, even though the capital investment will cover immediate or near-term needs.

Self-Check -6	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (6pts each)

1. Explain detail the pre-conditions prepared before preparation of storage facilities.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1. _____
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2. _____
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   _____

References

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2. https://naldc.nal.usda.gov/download/48355/PDF
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Dairy Production
Level-III

Learning Guide 30

Unit of Competence: Conserve forage

Module Title: Conserving forage

LG Code: AGR DRP3 M08 LO2- LG-30

TTLM Code: AGR DRP3 TTLM 1219 v1

LO 2: Prepare paddocks for forage conservation

Instruction Sheet	Learning Guide -30

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

- Closing paddock to stock access.
- Reporting the growth stage of the crop for harvest.
- Controlling pests, weeds and diseases

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

- Close paddock to stock access.
- Report the growth stage of the crop for harvest.
- Control pests, weeds and diseases

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2 and Sheet 3”.
4. Accomplish the “Self-check 1, Self-check 2,and Self-check 3” **in page -4, 7 and 12** respectively.

Information sheet 1	Closing paddock to stock access

1.1. Grazing management

Grazing management can be defined as the manipulation of livestock grazing to accomplish a desired result. The desired result depends upon the enterprise, but for most producers economic goals are of primary importance. Decisions regarding what grazing management to use are based on the characteristics of the forage being grazed, animal requirements, input costs associated with adopting a particular system, and the probability of return on investment.

Grazing management is a powerful tool that strongly influences pasture and animal performance. Choice of grazing management affects pasture yield, nutritive value, and stand longevity. Choice of grazing management also affects weight gain or milk production of an individual animal as well as the amount of milk or meat produced per acre.

In order to implement an effective grazing management program, there are a number of important issues of which we should be aware. These include a) what is required for plants and animals to be productive in a pasture-livestock system, b) what management choices have the greatest impact on success or failure of a grazing system, and c) how can the nutritional requirements of the animal be matched with the ability of the pasture to supply nutrients.

Paddock grazing is an efficient form of rotational grazing. Paddock grazing is where a farmers land is divided into paddocks by using an electric fence. It is a more intensive management system and requires higher capital costs in fencing, water and access routes. Each paddock is created to suit the the number of stock in the herd. A good rule to use is that 120 cows will graze 1 ha of young leafy grass in one day. The herd graze one paddock at a time, the farmer doesn't let them bare the paddock completely, as this allows a quicker recovery time for the paddock. Once the paddock is grazed the farmer has a choice - they can decide to put fertiliser or slurry on it depending on the situation.

When it is time for the stock to return to the paddock, the grass should be at the height of its digestibility. This allows the farmer to accurately match the nutritional demands of the livestock. This system can be quite expensive but is widely used on dairy farms. Silage fields are usually kept independent of the paddock system, as the small areas may be difficult to cut. Calves & replacement heifers graze any replacement grass. Paddock grazing systems are sometimes called rotational grazing systems.

Paddock grazing also ensures that stock are not re-grazing the same area day to day, which can help reduce the parasitic worm burden that livestock can get. In addition, paddock grazing offers farmers other options with their grassland, as it is possible for farmers to allocate relatively small areas of grass for silage or hay in places where grass has got too strong for livestock.

How Close

How close to graze is the decision that has the greatest impact on pasture and animal productivity. Some graziers use pasture height as the indicator of when it is time to move cattle from a pasture or provide supplement to the animals. Others have a concept of how many animals they can carry on their pasture over a growing season (stocking rate). They understand that during dry or cool periods the pasture may be somewhat overgrazed, but during wet and mild times the pasture may be undergrazed.

Whether decisions about how close to graze are based on pasture height or on stocking rate, closeness of grazing is very important. For the pasture, it determines how much leaf area is remaining after grazing and how many growing points are available to provide regrowth. As a general rule, tall-growing, bunch grasses that elevate their leaves and growing points should be grazed to a taller stubble height than low-growing grasses, like bahiagrass. The low-growing grasses typically have leaves and growing points at or very close to the soil surface to protect them from being overgrazed. For the animal, closer grazing forces them to eat more stem. Stem is less nutritious than leaf, so close grazing will result in lower weight gain or milk production per animal.

Undergrazing allows animals to select leaf to eat and does not stress the plant, but it results in poor utilization of the pasture resource. Although meat or milk production per animal may be high when pastures are undergrazed, production per acre will be low.

Self-Check -1	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (4pts each)

1. Explain the term paddock and the best number of animals per hectares of land per day
2. Explain how the farmers close the paddocks in general way.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1. _____
   _____
   _____
2. _____
   _____
   _____

Information sheet 2	Reporting the growth stage of the crop for harvest

2.1. Growth Stages of Cutting Pasture

Pastures are harvested at certain stages of their growth for conservation and subsequent utilization during periods of feed scarcity. Pasture harvesting is necessary for better supply of high quality feed, because forage dry matter progressively decreased with advancing maturity.

The quality of conserved forage depends on harvesting method and the moisture content at the time of harvest and storage. Different machineries are used in harvesting pasture species, due to their high efficiency compared to manual methods such as using cutlasses etc.

There are three growth stages of cutting pasture species in pasture harvesting

I. Pre-Flowering Stage:

This is a stage in pasture growth in which the pasture specie has more vegetative growth before setting flowers for seed production. This period starts from early stage of growth (3weeks after planting), up to 8 or 9 weeks post planting period in grass species.

However, in legume species, the period depends on the specie and management practices applied. During this stage, there are more leaves in the shoot and the stems are not hard (lignified). The moisture content of forage at this stage is 43 usually high with little dry matter content. Therefore, more material needs to be harvested before conserving for future use.

II. Flowering Stage:

At this stage, the pasture specie produces flowers for seed production. Fertilized ova result into immature seeds, which can be grazed by livestock or even defoliated for conservation. This stage is known as the bloom stage. The amount of dry matter at this

stage supersedes the moisture content, and therefore farmers normally harvest their pastures at this stage depending on the type of enterprise.

III. Post-Flowering Stage:

During this stage, seeds are set by the pasture specie. However, the moisture content of the seeds is still high compared to dry seeds. This stage is sometimes known as the dough stage in maize plant for silage. The forage at this stage contains high level of fiber for structural support. Livestock feed very little quantity of the forage material at this stage, even though the moisture content is very low.

2.2. Moisture Reduction Techniques in Pastures

Forages are made up of water and dry matter components. The amount of these components depends on stage of growth of the forage. However, moisture remains the most important factor to be considered before using or storing any material for future use.

Therefore, moisture content can be reduced from the forage by wilting the material for some few days after cutting. Thereafter, the wilted forage can be further sliced into fine, smaller cuts to facilitate moisture loss. Also, there has to be frequent turning of the forage material while in the field depending on the dimension, density and structure of the swath.

Self-Check -2	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (4pts each)

1. Explain Each stages of harvesting forages separately
2. Explain how the farmers or any forage producer reduce the moisture content of forage before storage.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1. _____
   _____
   _____
2. _____
   _____
   _____

Information sheet 3	Controlling pests, weeds and diseases

3.1. Methods of Weeds Control

Weeds are controlled using different methods depending on farmer's choice and resources available. The following methods are commonly used:

- **Manual method-** This involves identifying weeds in pastures and physically removing them by hand pulling. They can be gathered in one place, burnt and buried.
- **Chemical method**- Weeds can be controlled using chemical means such as herbicides. However, there are some negative implications to the environment and farmers.
- **Cultural method-** This involves weeds control using biological means such as grazing livestock or other species that can eliminate the weeds through competition etc.

3.2. Pests and diseases control

3.2.1. Biological vs. Chemical

There are various ways of controlling pests and diseases. The two most important and widespread methods are biological and chemical, but there are major differences between these two methods. This article will explain the background and principles behind each method, as well as the differences between them.

I. Chemical control

Chemical pesticides are often used to control diseases, pests or weeds. Chemical control is based on substances that are toxic (poisonous) to the pests involved. When chemical pesticides are applied to protect plants from pests, diseases or overgrowth by weeds, we speak of plant protection products. It is of course important that the plant that needs protection does not itself suffer from the toxic effects of the protection products.

Figure 3.1. Chemical pest control method

Pesticides are grouped into five main categories depending on the purpose they are usually applied for. The first group are:

- Fungicides, which are act against fungi.
- Then there are herbicides which are used against weeds. Herbicides are taken up by the leaves or the roots of the weed, causing it to die.
- Insecticides that, as the name suggests, destroy harmful insects.
- Acaricides which protect plants from mites.
- Finally there are nematicides to control nematodes that attack the plants.

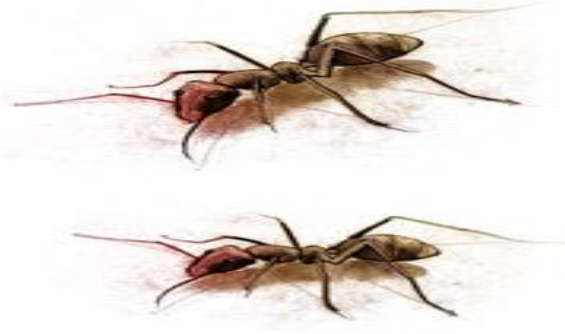

Figure 3.2. Pest

The advantages of chemical pesticides

- ❖ Widespread due to their relatively low cost
- ❖ The ease with which they can be applied and their effectiveness
- ❖ Availability and stability.

Chemical pesticides are generally fast-acting, which limits the damage done to crops.

The Disadvantages of chemical pesticides

The Four major drawbacks of Chemical pesticides are :-

1. Often not just toxic to the organisms for which they were intended, but also to other organisms.
    - ❖ Chemical pesticides can be subdivided into two groups: non-selective and selective pesticides.
    - ❖ The non-selective products are the most harmful, because they kill all kinds of organisms, including harmless and useful species.

For example, there are herbicides that kill both broad-leaf weeds and grasses. This means they are non-selective since they kill nearly all vegetation.

Selective pesticides have a more limited range. They only get rid of the target pest, disease or weed and other organisms are not affected. An example is a weed killer that only works on broadleaf weeds. This could be used on lawns, for example, since it does not kill grass. These days, a combination of several products is usually required to control several pests because almost all permitted products are selective and thus only control a limited range of pests.

2. A chemical pesticide is resistance.

Pesticides are often effective for only a (short) period on a particular organism. Organisms can become immune to a substance, so they no longer have an effect. These organisms mutate and become resistant. This means that other pesticides need to be used to control them.

3. A third drawback is accumulation.

If sprayed plants are eaten by an organism, and that organism is then eaten by another, the chemicals are can be passed up the food chain. Animals at the top of the food chain, usually predators or humans, have a greater chance of toxicity due to the build-up of pesticides in their system. Gradually, however, this effect is becoming less relevant because pesticides are now required to break down more quickly so that they cannot accumulate. If they do not, they are not permitted for sale.

Figure3.3. Food chain how chemical residues are stored in humans and animals body

4. The remains or residues of pesticides which are left behind on the crops.

Residue may be consumed on fruit or vegetables, for example, and for this reason crops may not be sprayed close to harvesting. Alternatively, the remains of pesticides may soak into the soil or groundwater and the contaminated water might then be used to spray the crops or be drunk by animals.

II. Biological control

Biological control is no fad. In China in the fourth century B.C., ants were used as the natural enemy of pest insects, and in South China today ants are still used to control pests in orchards and food stores.

Self-Check -3	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (4pts each)

3. Explain three different methods of weeds control
4. Explain pest and disease can be controlled in pasture production.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1. _____
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2. _____
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   _____

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Dairy Production
Level-III

Learning Guide 31

Unit of Competence: Conserve forage

Module Title: Conserving forage

LG Code: AGR DRP3 M08 LO3- LG-31

TTLM Code: AGR DRP3 TTLM 1219 v1

LO 3: Harvest forage

Instruction Sheet	Learning Guide -31

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

- Identifying Safety hazards
- Monitoring the weather conditions
- Determining optimum time for harvest and to ensure quality
- Identifying dry matter target for the forage operation
- Undertaking mow condition and rake swaths
- Conducting harvesting activities in a safe, controlled and efficient manner.
- Checking equipment during harvesting operations. .
- Baling, wrapping, compacting, sealing and storing forage.
- Loading, transporting, and storing/compacting forage.
- Storing forage

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

- Identify *Safety hazards*
- Monitor the weather conditions
- Determine optimum time for harvest and to ensure quality
- Identify dry matter target for the forage operation
- Undertake mow condition and rake swaths
- Conduct harvesting activities in a safe, controlled and efficient manner.
- Check equipment's during harvesting operations. .
- Bale, wrap, compact , seal and store forage.
- Load, transport, and store/compact forage.
- Store forage

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2 and Sheet 3”.
4. Accomplish the “Self-check 1, - Self-check 10” **in page -4, 7, 9, 11, 15, 17, 20, 26, 30 and 41** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1- 4,” **in page -43-45.**
6. Do the “LAP test” **in page – 46** (if you are ready).

Information sheet 1	Identifying Safety hazards

1.2. Health Hazards and Safety Risks

There are hazards and risks in all work places. Safety and health are possibly ensured only by knowing these risks and hazards and by properly guarding ourselves until the risks and hazards have been eliminated. Technological progress and change are constantly taking place and while they often bring improvements in both efficiency and safety at work, they also can create new risks and hazards

The four main contributing factors to accidents are during fodder production, management and conservation

A. Machines and Equipment

Faulty design and/or poor maintenance can lead to a sequence of events which finally may result in an accident.

B. Chemicals

Chemical substances applied before or during the Chemical weed and pest control in fodder production process can have an impact on safety and health of people exposed to these during the work.

C. Working Environment and Conditions

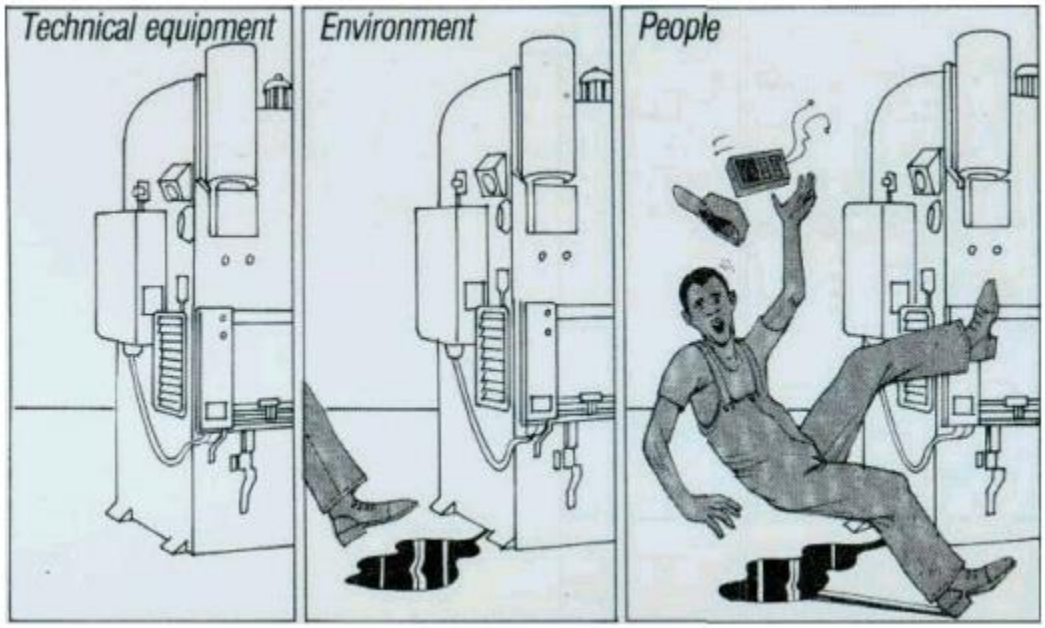
Influence workforce behavior and practices and thereby indirectly cause accidents or health risks. Such factors include

- Noise
- Disorder at the work place;
- Temperature and humidity;
- Ventilation in conservation area
- Lighting.

A. People

Managers' and supervisors' performance and behavior influence those of the workers with regard to following good work practices and being able to respond properly in case of an emergency. Important factors to be taken into account are:

- Job experience and training;
- Information and instructions on
- Working practices and hazards involved;
- Supervision by managers and skilled workers.



1.3. Following OHS Hazards in forage development

Personnel working in forage development are permanently exposed to hazards. These have either a physical, chemical or biological nature. Proper management is needed to avoid accidents and to keep the staff motivated..

Ergonomic, psychosocial and organizational factors

- Back pains and other musculoskeletal problems resulting from overexertion and wrong postures during working on forage development site and feed bags, shoveling of wastes, etc.
- Although work provides many economic and other benefits, a wide array of workplace hazards also present risks to the health and safety of people at work. These include but are not limited to, "chemicals, biological agents, physical factors, adverse ergonomic conditions, allergens, a complex network of safety risks," and a broad range of psychosocial risk factors.

1.4. Controlling Risks And Hazards

Some controls which could be put into place in your workplace for the above hazards are:

Slips and Trips

- Don’t leave things lying on the ground where someone could trip over them.
- Have signage up if floor surface is wet to prevent slips.
- Cover over cords etc. on floors so people don’t trip.

Lifting

- Never try to lift anything that is too heavy.
- Always ask for assistance.
- Plan your lift, particularly if item is large, awkward or possibly unstable.
- Be shown the correct procedure for lifting anything.
- Bend from the knees, not your back

OHS requirements

Work task is provided according to Occupational Health and Safety (OHS) requirements. This may include:

- Using of relevant protective clothing and equipment,
- Use of materials, tools and equipment,
- Creating conducive working environment and safety handling of material,
- Using First aid kit to provide aid services
- Hazard control and hazardous materials and substances.etc,

Self-Check -1	Written Test

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

1. List down the types of hazards (4pts)
2. Write the Occupational Health and Safety (OHS) requirements in work place.(4pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information Sheet 2	Monitoring the weather conditions

Climate-based strategic agronomic planning Weather plays an important role in agricultural production. It has a profound influence on pasture growth, development and yields; on the incidence of pests and diseases; on water needs; and on fertilizer requirements. This is due to differences in nutrient mobilization as a result of water stresses, as well as the timeliness and effectiveness of preventive measures and cultural operations with crops. Weather aberrations may cause physical damage to pasture and soil erosion. The quality of pasture produce during movement from field to storage and transport to farm for feeding depends on weather. Bad weather may affect the quality of produce during transport, storage and the viability and vigour of seeds and planting material during storage. Thus, there is no aspect of crop culture that is immune to the impact of weather. Weather factors contribute to optimal crop growth, development and yield. They also play a role in the incidence and spread of pests and diseases. Susceptibility to weather induced stresses and affliction by pests and diseases varies among crops, among different varieties within the same crop, and among different growth stages within the same crop variety. Even on a climatological basis, weather factors show spatial variations in an area at a given time, temporal variations at a given place, and year-to-year variations for a given place and time. For cropping purposes, weather over short periods and year-to-year fluctuations at a particular place over the selected time interval have to be considered. For any given time unit, the percentage departures of extreme values from a mean or median value, called the coefficient of variability, are a measure of variability of the parameter. The shorter the time unit, the greater the degree of variability of a given weather parameter. The intensity of the above three variations differs among the range of weather factors. Over short periods, rainfall is the most variable of all parameters, both in time and space. In fact, for rainfall the short-period inter annual variability is large, which means that variability needs to be expressed in terms of the percentage probability of realizing a given amount of rain, or that the minimum assured rainfall amounts at a given level of

probability need to be specified. For optimal productivity at a given location, pasture and cropping practices must be such that while their cardinal phased weather requirements match the temporal march of the relevant weather element(s), endemic periods of pests, diseases and hazardous weather are avoided. In such strategic planning of crops and cropping practices, short-period climatic data, both routine and processed (such as initial and conditional probabilities), have a vital role to play.

Self-Check -2	Written Test

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

1. Define weather and the impact of weather on pasture production (8pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information Sheet 3	Determining optimum time for harvest and to ensure quality

One of the most critical factors in making quality dry hay is timing. Producers need to time haymaking to coincide with the right stage of plant growth and weather conditions. The old timers used to talk about cutting hay around the Fourth of July, when they said “it was stout and had some bottom to it.” Although maximum growth of the plant and peak yields occur around that time, the nutrient value is greatest earlier in the season, when plants put most of their energy into vegetative growth and contain high concentrations of starches, proteins and minerals.

As plants mature, their lignin content (a component of fiber) increases and traps the nutrients within indigestible cell walls. Although cutting hay early will result in lower yields, the increase in nutritive value will compensate for reduced yields. The second, third and fourth cuttings that grow back are leafy and high in quality and often harvested when the weather is hotter, making the hay easier to cure. Sometimes growers need to make a little sacrifice by getting an early first crop from the field during periods of rainy, early summer weather in order to get the next crop growing.

One important part of timeliness is having the equipment maintained and ready to go when the grass is ready. The winter months are a good time to check the equipment over and replace any worn or broken parts. A delay in harvest caused by an equipment breakdown can never be made up. It is good to have an early start date for haying just to get things ready. Shoot for a goal of May 15, in southern areas and May 25, farther north, even though conditions may not be right at that time every year.

Self-Check -3	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (2pts each)

1. One of the most critical factors in making quality dry hay is timing (True/False)
2. As plants mature, their lignin content (a component of fiber) increases and traps the nutrients within indigestible cell walls. (True/False)
3. The first step in haymaking is mowing the hay. (True/False)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

2._____

3. _____

Information Sheet 4	Identifying dry matter target for the forage operation

A key decision in making silage is the DM content at which to harvest the crop. The DM content at ensiling determines the potential ensiling problems that may be encountered. On the wet side (<30% DM typically), silage effluent and clostridial fermentation losses may be significant. In dry forage (particularly >50% DM), losses may increase during wilting from precipitation and mechanical losses and later during storage from heat damage and spoilage. Thus ensiling in the 30 to 50% DM range would seem best, wetter (30 to 40% DM) with horizontal silo types and drier (40 to 50% DM) with tower silos. Such a range minimizes the potential for clostridial fermentation and silage effluent as well as provides a low porosity to minimize spoilage losses during storage and feed out.

The following are some factor determining the DM contents:

- Type of forage (grass, legume, etc.)
- Target animals to be fed
- Specific weather conditions
- Harvesting equipment
- Labor available to the farmer
- Silo type
- Silage additives available
- Means of handling effluent
- specific losses associated with weather, equipment
- Silo type and management.

Self-Check -4	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (6 pts each)

1. Explain the determinants of DM contents.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

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Information sheet -5	Undertaking mow condition and rake swaths

5.1. Mowing

Providing pasture is at or only slightly past grazing height, and harvested in good weather conditions, milk production will be only marginally less than if the same pasture had been grazed by the cows. Wilting rate of the mown pasture has a big impact on silage quality. The time of day that pasture is cut impacts on the wilting rate.

The best time to mow is in the afternoon as grass sugar levels will be peaking. Exposure to the midday sun will allow the grass to photosynthesise, resulting in higher energy levels and the ley should be free from rain or dew. The use of a conditioner is often debated. With the waxy cuticle being broken by the conditioner, wilting can be increased by up to 20%.

The following should be considered when deciding on mowing time to aid rapid drying but to avoid overdrying:

- Mow after dew has lifted.
- Match mowing and harvesting operations so that mown material is not left unharvested for lengthy periods.
- Reduce wilting periods for forages, such as legumes and young, leafy plants.
- Delay mowing until mid to late afternoon to reduce the risk of overdrying the forage during hot, dry and windy weather.
- Stagger mowing and narrow the swath width if there is a real risk of over-drying.

Mower blades will also be blunted and the risk of contamination from soil and stones will increase. It is important to carry out regular in-field checks to make sure you are getting the best from your harvesting machinery. They do not take long and can have

huge benefits. Mower blades should be regularly changed as blunt blades will not cut the grass cleanly, dramatically slowing regrowth.

Setting your mower to spread or swath is down to conditions on the day, but this basic rule can help. If the ground is dry, set the mower to spread full width to maximise the surface area of the crop for rapid wilting. If the ground is wet, leave the grass in a swath, allowing the ground to dry out either side before tedding.

Tedding will help to achieve a rapid wilt and ensure the grass is evenly mixed, ensuring a uniform wilt and therefore more uniform quality, with fewer hot/wet spots in the clamp or bale. The tedder tines must be set to 2-4cm above the ground, and this should be set in the field.

Figure 2 Mowing

5.2. Wrapped bales

Another newer method of making silage is the wrapped bale. It is principally popular on smaller farms and provides the farmer with considerable flexibility in terms of harvesting and feeding. Several wrapping systems are available: stretch wrap plastic on individual round and rectangular bales or large round bales arranged end to end and either placed in a plastic tube or wrapped with stretch wrap. These latter alternatives reduce the plastic used, greatly increase the wrapping productivity and reduce the storage space

compared to individually wrapped bales. However, tubeline wrapping can reduce feeding flexibility compared to individual wrapping.

5.3. Raking

Presentation of the swath to the subsequent harvesting machine has a big impact on efficiencies and quality – an even, box-shaped swath for a smooth, consistent flow is required. Row up just before harvest so the grass quality remains uniform – too long in the swath and the top will wilt more than the bottom, producing an inconsistent dry matter.

Correct working height of the rake is important, otherwise you will either pick up stones and soil, or leave grass on the ground which will rot and damage the subsequent cuts. Ideally a rake with electric height adjustment should be used as the rotor working height can be adjusted on-the-move to suit varying conditions. Again, as with tedding, match the tractor forward speed to the RPM of the pto shaft; higher dry matter crops will take less moving then wetter crops, so you risk throwing it too far or leaving some behind.

Self-Check -5	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (6 pts each)

1. Explain the Conditions to be considered when deciding on mowing time to aid rapid drying.
2. Explain the importance of Wrapping bales

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

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Information sheet 6	Conducting harvesting activities in a safe, controlled and efficient manner.

6.1. Harvesting

The type of silage required will influence which harvesting technique is used. Commonly a forage harvester or wagon is used for high-quality silage, with lower energy crops being baled for feeding to dry cows. When choosing equipment, ensure there is enough capacity to manage the crop in the clamp at the same time as harvesting, so that every stage of the silage-making process can be undertaken at the correct time.

The same is true of using a contractor ensure they can do what you want, when you want, to achieve the right quality silage. Savings on contractor fees can quickly be lost through reduced quality forage. Silage is made by pickling the grass, which is the result of good bacteria fermenting some of the grass sugars into lactic acid, which in turn prevents the growth of bad bacteria and preserves the nutrients. Swaths

The fermentation process is anaerobic, and will therefore only happen once all the air is excluded from the clamp or bale. Furthermore, soil introduced into the grass as a result of poor harvesting techniques can introduce harmful bacteria which will spoil the silage and pose as a potential health risk to the livestock. When collecting grass from the swath make sure the pick-up height is set correctly preventing the tines from collecting soil or stones.

Whichever harvesting technique you have chosen, all knives should be kept sharp as this will produce a cleaner cut and reduce fuel consumption. Many people wrongly think that giving the knives an occasional ‘good’ sharpen is best practice, when actually sharpening a little and often will save time and fuel while helping to prolong the life of the knifes

Self-Check -6	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (6 pts each)

1. Define harvesting and how harvesting of forage takes place.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

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Information sheet 7	Checking equipment's during harvesting operations

7.1. Hand tools maintenance and use

Sickles are designed for cutting cereals, but are poorly adapted to mowing hay, and very slow and laborious in comparison to the scythe. They are, nevertheless, widely used, especially in India and Pakistan, Ethiopia often in a blunt, saw-edged version. Where farms are very small and haymaking a secondary task, equipment is kept to a minimum.

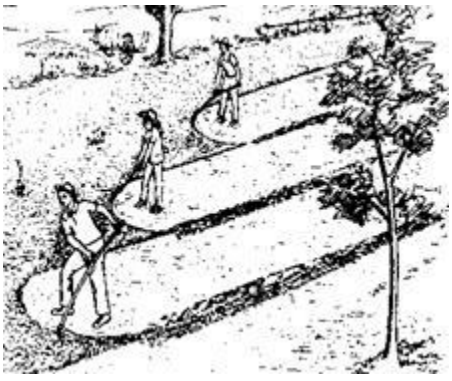
The scythe can mow at about five times the speed of the sickle. However, it requires:

- A sward that is reasonably free from obstacles
- To be kept very sharp by regular whetting throughout the day,
- Some skill to use the scythe, and
- Both hands for usage.

Forage crops are mown with wide cuts, advancing in a straight line and cutting away from the standing crop.

a. Parts of a scythe

b. How to use a scythe



c. Field mowed using a scythe

Figure 7.1. Mowing forage using a scythe.

A scythe cuts wheat faster than a sickle, but it does not leave bunches ready to tie. Where the preference in cereal harvesting is for the sickle, small-scale farmers seem loath to acquire additional cutting tools for the minor hay crop.

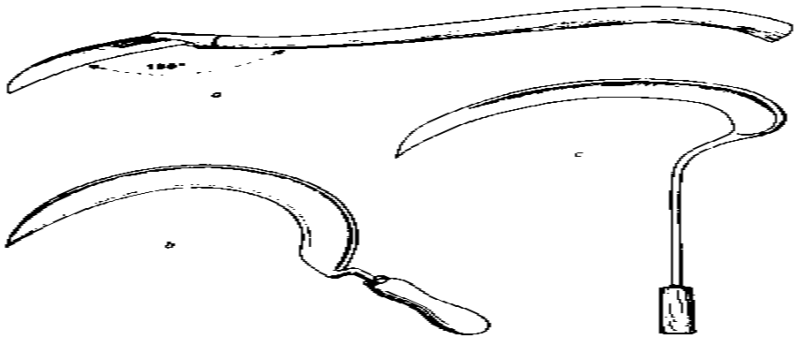


Figure 7.2. Types of Sickle

7.2 Machinery Maintenance

Farm machinery like tractor, harvester, baler and the others machinery used in forage establishment to conservation should maintained based on the guidance of professionals under good maintenance operation.

The machine must be adjusted according to the type and moisture content of the hay, which will vary according to the time of day and position in the field, so continual operator attention is essential. Moist hay gives heavy bales, which may burst the strings if too dense and/or too large. Light, stemmy hay gives light bales with loose strings. Bales should be examined for moisture content and shape as they leave the chamber

Self-Check -7	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (6 pts each)

1. Explain the equipment and tools for harvesting under most part of our country..
2. Explain some machinery used harvesting forages

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

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Information sheet 8	Baling, wrapping, compacting , sealing and storing forage

8.1. Baling

Science and art converge in haymaking with the critical decision of when to start baling. Baling hay too early will trap moisture in the bale and result in spoilage. Baling too dry will cause leaves to shatter and break, lowering hay quality. It takes close visual observation and handling of clumps of hay from several windrows to “feel” if it is ready. Hay ready to bale will have no bunches of green grass. It will have a brittle, crisp feel.

To test its readiness, grab a clump of hay and hold one end of the clump in each hand. Pull vigorously with both hands. If the stalks break on the first pull, the hay is ready to bale. If it takes several pulls, it’s still too green.
Some haymakers like to use an electronic moisture tester to confirm their own observations.

Improperly cured hay (hay above 22 percent moisture) can also heat in the barn and cause a fire by spontaneous combustion. Generally hay is baled at a moisture content between 15 percent to 18 percent. Hay stored at more than 22 percent moisture in a barn or stack is at risk of spontaneous combustion.
When the internal temperature of hay reaches 130°F a chemical reaction begins to produce flammable gas that can ignite if the temperature goes high enough. At 150°F you enter the danger zone. Anticipate hot spots or fire pockets at 175°F. At 185°F remove the hay from the barn, with the fire department standing by to control flames as air contacts the hot hay.

- Alternatively, a “baling box” can be used to make a tightly packed bale, tied with string. This will reduce wastage from shattering and make storage easier.
- In places with a long and severe dry season, tree legumes may lose their leaves during the driest period. Instead of being wasted, the leaves can be collected, dried,

and used as a protein supplement. Herbaceous legumes such as desmodium can also be dried and stored.

- Legumes should be cut and carried to the place of storage when green to avoid losses from the shattering of leaves. Tree legume branches should be cut and the leaves allowed to dry on the branch. They can then be easily stripped off the branch and stored in a sack for later feeding.

Step 1. Make a box Step 2. Put twine in Step 3. Put in roughage and compact

Step 4. Tie up the compacted roughage Step 5. Remove the bale

Figure 1.1 Manual Balling

8.2. Wrapping

The high surface area to volume ratio for bales (half the silage volume is within 12cm of the plastic) means DM and quality losses can be high if the stretch wrap fails. Minimize losses by using quality stretch wrap and the correct wrapping technique to ensure a cover of at least four layers of plastic. The preferred 2+2 system.

Round bales stored on the flat surface retain their shape better and are easier to feed out. The multiple layers of plastic on the ends also provide greater protection from direct sunlight and sharp twigs or stones between the bale and the ground.

Advantages of individually wrapped bales:

- ❖ Flexible system suitable for small batches;
- ❖ No construction costs for storage;
- ❖ Flexibility in locating storage site;
- ❖ Existing hay-making equipment may be used;
- ❖ Easy to monitor silage stocks;
- ❖ Convenient to handle and feed out;
- ❖ A saleable commodity.

Disadvantages of individually wrapped bales:

- ❖ Not suitable for all crop types;
- ❖ High cost per tonne of silage DM produced
- ❖ Susceptible to damage if handled after wrapping
- ❖ Susceptible to bird and vermin damage
- ❖ Short-term storage (12 months)
- ❖ High feedout costs for large quantities
- ❖ Plastic disposal is an issue.

Compact stacks and make bales as dense as possible

The better the compaction, the less air will be trapped in the stack or bale resulting in a higher quality silage

For bulk stacks:

- ❖ Chop material short (10–30mm)
- ❖ Spread the forage thinly (150mm) to ensure thorough compaction
- ❖ Roll slowly to allow the tractor weight to compact the forage.

For baled silage:

- ❖ set bale density as dense as possible on the baler

- Slower baling will increase bale density
- Chopping balers (knives) can increase density by 8–15 per cent
- Ensure feedout equipment can handle shorter chopped bale silage.

Figure 1.2 Wapped Silage Bales

Seal airtight as soon as possible after harvesting

Seal stacks, don't just cover them

- Finish rolling immediately after harvest is completed. Avoid rolling the next morning as this just 'pumps' more oxygen into the stack.
- Rolling should keep up with forage delivery from the paddock.
- Seal pits or stacks as soon as harvest is complete.
- If leaving overnight minimise air getting into the stack by placing plastic on the stack and weighing down the edges.
- Finish weighing down the stack next morning and ensure seals are airtight.

- For an airtight seal use gravel bags, filled with pea gravel or washed sand along bunker walls and stack surface. Even a double row of tyres around the perimeter does not achieve an airtight seal.

Figure 1.3 Sealing steak with bags

Storage

Hay can be kept for long periods if properly made and correctly stored; in contrast, it can deteriorate rapidly and even be lost by careless storage. The aim in storing hay is to keep it dry and to protect it from wastage due to rots, pests, stray livestock, fire or wind.

Storage areas, whether stack-yards or for bales, should have a dry foundation throughout the year, not only at the season of storage. They should be accessible all year round to the type of transport used, and protected from stray livestock and any fire risk. Where possible, it is better to store close to the point of use rather than in the field. Barn storage is ideal, of course, but is not always feasible.

Self-Check -8	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (5 pts each)

1. Explain the advantages and dis advantages of individual wrapped bales.
2. Explain the importance of Balling.
3. Explain the importance of storage in pasture production.

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

_____

_____

_____

2._____

_____

3. _____

_____

_____

Information sheet 9	Loading, transporting, and storing/compacting forage.

9.1. Collection, loading and transport

Horse-drawn sweeps were developed to push several sections of windrow together for ease of collection, and some have a tumbling action so that they discharge easily. Cranes were also used for loading hay onto wagons or from wagon to stack, and in the field they were especially useful where intermediate on-field stacking was used. Such equipment was used on large farms, and these are now highly mechanized. In small-scale farming systems, loading is by fork and hay is transported on carts, which may be temporarily modified by the addition of frames to increase their base area to allow transport of a greater load of bulky material.

Figure 1.1. Manual Loading

Loading using simple mechanization

Small tractors are becoming increasingly common in developing countries, and often their owners do some contract work as well as tending their own farms. Old and simple techniques of mowing and sward handling can be introduced with a minimum of equipment and investment, but can speed up and improve haymaking a great deal. A mower, dump rake and some frames to expand the loading area of existing trailers will go a long way toward mechanizing the hay harvest. In the case study on Altai, for example, a centrally-run machine pool with heavy equipment proved less attractive than

simple mechanization run by farmer-contractors with the kind of equipment mentioned above.

Figure 1.2 Loading using machinery

Compacting/ Storing forage

A silo is a structure designed to store and preserve high moisture fodder such as silage. The selection of a silo is made on the basis of required capacity, climatic conditions and economic considerations. Different silo types are used to conserve and store fodder:

- Horizontal silos, such as trench silos and bunker silos
- Vertical silos, such as pit silos and tower silos.

Hay can be made into round or square bales. Contrary to some beliefs, large, round bales don't offer more flexibility in moisture content, but must be adequately dried. Since the core is packed very tightly, moisture can't escape, accelerating heat build-up. Some people store large, round bales outside, but with a 6-foot diameter bale,

approximately 30 percent of the hay is wrapped in the outer six-inch layer. A few inches of spoilage results in a significant loss of dry matter.

Big, round bales can be stored in a large, high-clearance shed; grouped in stacked rows and covered with plastic, or individually wrapped as they are baled. While round bales do offer the advantage of mechanical handling, they may be difficult to market to small livestock producers.

Self-Check -9	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (5 pts each)

1. Explain the different types of silos for silages storage.
2. Explain the best way of hay compacting to minimize spaces of storages.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

_____

_____

_____

2._____

_____

Storing forage

The yard must be kept tidy throughout stacking and storage, and vermin such as rats should be eliminated if possible. Apart from the damage they may do, rodents in stacks in warm areas attract snakes, which can be distracting to the labour when the hay has to be taken out for livestock feeding. Termites are another possible cause of damage. In areas subject to high winds, windbreaks, such as earth walls, have to be constructed, else it is not possible to store hay in the open. In severe cases, the stack may be no higher than the windbreak.

Storage of hay and straw in the forks of trees is widespread, especially for straw, in order to keep it out of reach of wandering livestock

Silage storage should allow an aerobic respiration which results for mold development a great deterioration in forage quality and lead to animals poisoning.

House-top storage is very common on smallholdings in semi-arid areas where flat-roofed houses are traditional; the house roof is often used as a drying area for other crops, as well as hay. In areas of negligible precipitation, this is an excellent storage method, but where there is rain the hay will be damaged by weathering.

Fire Risks

Hay is easily set on fire, as are dry crop residues, so care must be taken in siting stack-yards and storage so as to minimize the risks. Stored hay may be accidentally ignited by household fires, by smokers' carelessness, by sparks from bush fires, and so on. Care in siting, cleanliness - including tidying up of loose hay which could carry fire and avoidance of smoking or other sources of fire near or in the stack-yard will help prevent accidents. Where dry fodder is stored on or close to houses, extra care is needed. Spontaneous combustion can occur when hay is stored at too high a moisture content.

Haymaking is dominant in those areas of the world where good drying conditions prevail. However, it may also be used in humid climates where ensiling has been considered too difficult because of forage characteristics, high temperatures or tradition.

In ensiling, the crop is fermented anaerobically by lactic acid bacteria present on the crop. Preservation depends on:-

1) A low pH to inhibit clostridia and other detrimental anaerobic microorganisms
2) Anaerobic conditions to prevent the growth of aerobic spoilage microorganisms such as yeasts and molds.

Ensiling has been practiced primarily in the humid temperate portions of the world, where DM and quality losses in making hay may be excessive. Harvest losses increase with DM content. The drier crop and the increased drying time increase respiration losses and the chances for losses from rain during wilting. Mechanical losses also increase when equipment processes a drier crop. Conversely, storage losses generally decrease with increasing DM content, particularly for hay.

Storage losses for silage are generally higher than for hay but are more dependent on the type of silo and silo management than on DM content.

1.2. Hay Making

Hay is feed produced by drying green forage to a moisture content of 15% or less. It is the most commonly stored fodder on the farm and used to level-out the feed supply throughout the year. Hay is generally the most convenient processed form of storage and an appropriate forage conservation method for small-scale farming. Well-processed hay is the cheapest form of feed during the non-grazing season.

Storing fodder is an important operation in livestock farming to bridge the gap in feed supply during dry seasons, recurrent drought hazards, and during the cropping season when grazing land becomes scarce. The aim of conserving fodder is to harvest the crop at its maximum nutrient content and minimize losses while at the same time maintaining

its acceptability to the animal. The time of harvest may be earlier if higher protein content is required or later if maximum dry matter is desired. Therefore, time of cutting is a compromise between quality and quantity of the harvested forage. Fodder is usually conserved as hay and sometimes as silage especially for dairy business.

Problems in haymaking vary according to the crop, climate and prevailing weather at harvest:

- **Sub-humid and humid conditions:**
  - ❖ Slowness of drying (the aim is to dry the crop as quickly as conditions will allow to avoid loss by spoilage).
- **Hot, dry conditions**:
  - ❖ Too rapid drying
  - ❖ Shattering of the finer parts of the plant.
  - ❖ Bleaching, with consequent loss of carotene and vitamins.

1.1.1. Curing of hay

The grass should be dried quickly and not unduly exposed to the sun. Rain can cause leaf losses and leaching of nutrients. The loss of nutrients in haymaking is:-

- ❖ About 25% for temperate pasture grasses
- ❖ About 22–25% for tropical pasture grasses.

Tropical pasture grasses generally take 50–55 hours of drying in good weather and 70–75 hours in poor weather.

Hay-making steps for the smallholder

- ❖ Harvest the plant at the optimum stage of maturity to maximize nutrient yield per unit of land. Most forage should be cut just after reaching an early bloom stage.
- ❖ Start harvesting after the dew has evaporated from the green material in late morning.
- ❖ Cut and place the material into small heaps about 20–30 cm high and turn the heap frequently in the sun to encourage quick drying. Raking (turning) should be

completed before it is completely dry to avoid excessive shattering of leaves and overexposure to the sun. It is better if raking is done when the dew is on, especially when high leaf-shattering is expected. If the weather is humid or rainy, place the cut material off the ground using a home-made tripod with three poles to facilitate drying

- The optimum permissible moisture content for storing hay is around 18–22%.
- When the initial moisture has evaporated, the material can then be placed under the roof of any shed, and allowed to dry completely away from the sun.

Figure 1.1. Hay in carefully built thatched stacks

Figure 1.1. Hay storage area

Common losses of haymaking

- **Leaf shattering**
  - Leaves contain 2 to 3 times as much protein as stems.
  - Leaves are also richer in carotene, B-vitamins, minerals, and energy.

- **Heat damage**
  - Hay stored with excess moisture (25–35%) may tend to mold, and contain bacterial growth and heat.
  - Hay stored dry reaches a maximum of about 29^{o}C.
  - Above about 49^{o}C, nutrient destruction or binding occurs. Proteins are most vulnerable to heat damage.
  - When temperature of stored hay reaches 71–73^{o}C, there is a danger of spontaneous combustion

- **Fermentation/plant cell respiration**
  - Converts sugars and starch to CO2 and H2O representing a loss of nutrients.
  - Reduces energy value.
  - Destroys carotene.
  - Under good condition, accounts for 5–7% of loss in total dry matter.
  - Rapid drying is the key to low fermentation losses.

- **Bleaching**
  - Color loss due to destruction of chlorophyll by sunlight.
  - Reduces carotene (related to greenness) or Vitamin A.

- **Leaching**
  - Washing of nutrients out of the hay by rainfall.

Factors influencing hay quality

I. **Maturity:** Affects both yield and composition of hay.
   - Young plants are more digestible because they have less structural fiber and lignin, which are difficult to digest.
   - Young plants are higher in protein, minerals and carotene than older plants.
   - Young plants are more palatable, tender and less fibrous.

II. **Leafiness:** Applies mainly to legume hay.

- ❖ The percentage of leaves is the best index of actual feed value of alfalfa, clover and other legume hays.
- ❖ Leaves are higher than stems in protein, fat, ash, nitrogen-free extract, calcium and phosphorus.
- ❖ Leaves have a higher digestibility than stems.

III. **Color:** Is an indication of maturity, the care exercised in curing, and the amount of weather to which the hay has been exposed.

- ❖ A high percentage of natural green color (pea-green color) in hay indicates early cutting, good curing, high palatability, freedom from must or mold and high carotene content.

IV. **Foreign matter:** Indicates hay of low feeding value.

- ❖ Injurious foreign matter, such as wire, stones, etc
- ❖ Poisonous plants, hard, bearded grasses etc

V. **Condition:** Refers to soundness of hay. Unsound hay is an indicator of poor quality and low nutrient content.

- ❖ Contains excess moisture (under-cured).
- ❖ Heated or hot hay, perhaps a burnt-brown appearance.
- ❖ Has a musty or sour, rotten odor, generally due to heating.
- ❖ Moldy.
- ❖ Lacks the aroma of well-cured hay.

VI. **Texture:** Refers to the size of the stems. Texture is influenced by the thickness of the stand, maturity, percent leaves and the rainfall, soil fertility and other environmental conditions affecting the rankness of growth.

VII. **Variety:** Refers to kind or variety. Legume hay is more valuable than grass hay of the same maturity condition and foreign-matter content.

Standards of hay

II. Hays from sown pasture

Standards or grades of hay are generally based upon the percent of leafiness (in legumes), percent green color, percent foreign material, maturity or ripeness when cut, size and pliability of the stems, and general condition.

III. Hays from natural pasture

Three broad standards (grades) of hay are recognized based upon legume composition and quality of processing (curing) the hay.

B. Excellent hay

Excellent hay is cured forage, which includes a mixture containing a large amount of legumes and some grasses which are cut at an early, immature stage shortly after the legumes begin to bloom (1/8–1/4 of the plants in bloom) or shortly after the grasses form a head. For hay to be excellent quality, it must not be exposed to weather damage of any type, including sunlight for more than one or two days.

C. Good hay

Good hay would be cured forage which contains smaller amounts of legumes and more grasses than excellent forage and is cut at a slightly later stage of maturity (about ½ of the plants in bloom). For hay to be rated as good quality, it must have little or no weather damage.

D. Fair-to-poor hay

Fair-to-poor hay is that which is mature at harvest (most of the plants in bloom); contains little or no legumes, and is exposed to some but not excessive, weather damage.

1.2. Silage Making

Silage is moist forage that is the product of acid fermentation of green forage crops that have been compressed and stored under anaerobic conditions in a container called a silo.

Advantages of silage making

- Where the production of high quality hay is not possible due to weather conditions.
- Silage saves feed that would be inedible in the dry state or would be damaged by rains.
- It is quite palatable and has a high content of carotene.
- It clears the ground early and completely for another crop
- Storing a crop as silage instead of hay eliminates the hazard of fire.

Limitations of silage making

- It requires additional outlay for structures, equipment and power.
- It concentrates the labor of harvesting into a few days since the silo has to be filled quickly (in 1–3 days).
- Most silage has a low content of minerals and protein and is not suitable for use as the sole ration.
- If it is fed in place of legume hay in the ration, more expense must be incurred for high-protein feed.

Skip to Differences between Silage and Haylage

The main difference between silage and hayage is the initial dry matter (DM) concentration level at which the forage is clipped and packed to achieve optimum anaerobic and fermentation conditions. Three different moisture levels can be achieved: high-moisture silage (≤ 30% DM), medium-moisture silage (30% to 40% DM), and low-moisture (wilted) silage (40% to 60% DM). Low-moisture silage is referred to as haylage. When baled and wrapped, haylage is referred to as baleage. High-moisture silages are more prone to potential seepage losses (that is, effluent or leachate from the silo), undesirable secondary fermentation (resulting in butyric acid, which results in a rancid smell), and high dry matter losses (silo shrink). On the other hand, preservation as haylage depends more on achieving adequate packing (high density) to maintain anaerobic conditions. Achieving high density at packing is more

difficult in drier forage. Nevertheless, high density is critical in haylage to maintain anaerobic conditions because microbes are less active and fermentation is lower in haylage than in higher moisture silage.

Kinds of silos

Generally, there are four types of silos: stacks, trench silos, bunker silos and tower silos. The common ones applicable to the smallholder are stacks and trench silos.

Crops suitable for silage

Any green forage crop can be made into silage that will keep in good condition without an excessive loss of feed nutrients. Few feeds are improved either in palatability or in nutritive value by undergoing fermentation in the silo. Very coarse or weedy crops and spiny plants become completely edible when made into silage.

E.g. Maize, Sorghum, different legumes and grass with hallo steam and broader leaf

Harvesting the crop and filling the silo

- The fodder may be cut by hand and chopped by homemade, manually-operated rotary choppers that are more efficient than chopping by sickles.
- Hay and pasture crops may be cut using sickles or scythe and transported by animal-drawn carts to be dumped directly into the silo.
- In packing trench silage, livestock can be driven back and forth over the chopped material.
- Grasses and legumes need more uniform packing; such silages shrink away from the sides so special attention should be given to packing the top.
- It is advisable to fill the upper part of the silo higher than the sides.
- After filling, the silo should be covered with straw or un-chopped maize and then covered with a polythene sheet.
- Trench silos must be filled high above the ground and then covered with straw and dirt. This will help to prevent spoilage by rain.

The fermentation process in the silo

When a green crop is put together in a heap, it continues to respire and in the process oxygen is consumed, CO2 produced, and heat is developed. Several aerobic bacteria continue to increase in number until the oxygen is used up in 1–4 hours. The desirable temperature of silage after respiration stops is 27–38^{o}C. If the temperature is lower, lactic acid-forming bacteria cannot compete with butyric acid-forming bacteria. On the other hand, temperature above 38–49 ^{0}C result in sweet, tobacco-smelling, dark brown silage being formed; this is palatable but nutrients are lost (especially protein). The amount of fermentation products, lactic and acetic acids depends highly on the amount of sugar in the material from which these acids are derived by fermentation. A sugar content of about 6% is necessary for successful silage.

The normal fermentation process lasts about 21 days. Silage (maize) has been known to keep well for 12 years or more.

Self-Check -1	Written Test

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

PART I. Choice the correct answer (3pts each)

1. A producer should consider the following except one While selecting a conservation method for forages
   A. The suitability of the forage for a given method
   B. Storage capability
   C. Weather conditions
   D. The intended use of the conserved forage.
   E. None
2. Among the following which one is the factors influencing hay quality
   A. Maturity B. Leafiness C. Color D. Condition E. All
3. Of the following one is the Advantages of silage making
   A. Production of high quality Silage when weather condition not allow hay making.
   B. Feed that would be inedible in the dry state used in silage making as edible
   C. Quite palatable
   D. Eliminates the hazard of fire
   E. All

PART II. Matching Type (3pts each)

A	B
1. Moisture content of hay	A) 30-40%
2. Stage of harvesting hay	B) 18-22%
3. End product of anaerobic fermentation	C) Silage
4. Dry matter level for silage	D) at flowering stage

Note: Satisfactory rating – 12 points unsatisfactory rating –below 12 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1. _____
2. _____
3. _____

Matching

2. _____
3. _____
4. _____

Operation Sheet 1	Baling hay using a box

Steps

1. Make a box Step
2. Put twine in Step
3. Put in roughage and compact
4. Tie up the compacted roughage
5. Remove the bale

Operation Sheet- 2	Hay Making

Steps

1. Select suitable personal protective equipment (PPE) and wear it
2. Harvest at optimum stages of flowering as dew evaporated
3. Turn the harvested grass two to three days daily until comptelty dried
4. Hip into small piaces as it suitable for collecting
5. Store it at the storage site at optimum moisture conten of 18-22%
6. Provide it for the livestock's as it required

Operation Sheet- 3	Silage Making

Steps

1. Select suitable personal protective equipment (PPE) and wear it
2. Harvest at optimum stages of Maturity on the Good day
3. Chop it to required size for conservation
4. Pack it in the previously prepared pit by removing the air from it by compact
5. Cover it with appropriate Thatch or plastic sheets
6. Keep it air tight and provide for the animals starting from 21 days (Take care of The poisons developed due to Molds and an appropriate storage)

LAP Test	Practical demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 3 hour.

Task 1. Bale hay manually

Task 2. Make a hay

Task 2. Make a silage

References

1. https://extension.psu.edu/managing-machinery-and-equipment
2. https://aces.nmsu.edu/pubs/_circulars/CR641/
3. https://extension.psu.edu/forage-quality-testing-why-how-and-where
4. https://extension.psu.edu/forage-quality-and-testing
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Dairy Production
Level-III

Learning Guide 32

Unit of Competence: Conserve forage

Module Title: Conserving forage

LG Code: AGR DRP3 M08 LO4- LG-32

TTLM Code: AGR DRP3 TTLM 1219 v1

LO 4: Complete operations

Instruction Sheet	Learning Guide -32

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

- Completing records
- Disposing all waste and debris
- Cleaning and servicing machinery and ancillary equipment
- Testing or sampling stored forage for quality
- Reporting environmental impacts of forage conservation activities

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

- Complete records
- Dispose all waste and debris
- Clean and service machinery and ancillary equipment
- Test or sample stored forage for quality
- Report environmental impacts of forage conservation activities

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2 and Sheet 3”.
4. Accomplish the “Self-check 1, Self-check 2,and Self-check 3” **in page -5, 7, 10, 13, and 16** respectively.

Information sheet 1	Completing records

2.1. Pasture Records

Keeping pasture records is an important part of good pasture management. With written records you can see the results of management changes as well as weather impact on both forage and livestock performance.

Your records should include weather data- amount of rainfall, frost dates, and extreme summer temperatures. Forage or sward information on species mix in the pasture, additional fertility applied, and pasture growth at different times during the grazing season.

Livestock information including size, type and number of animals on the pasture, frequency of moves to new paddocks, beginning and ending dates of the grazing season, amount of residual forage and any supplemental feed required.

This is a long list but the records can be as simple or as complicated as you wish.

There are a number of tools to assist in measuring the amount of forage present. Height and density are the two important components. The use of a grazing stick or a rising plate meter will help in determining the quantity of forage present. There is such a wide variation in the species composition of our Ontario pastures that the accuracy of these measuring devises leaves a lot to be desired.

If you take a close look at the pasture density and height along with current stocking rate you should be able to estimate the number of animal days per acre that is present.

A notebook will provide the basics for the record keeping and will over time give a clear picture of your grazing management. By recording and accumulating this information you will be able to make grazing decisions that will have a positive benefit to your operation.

Each year is different in the grazing business but with information you will be able to analyze the differences and manage your pastures for maximum returns.

1. Rain fall records

Day	Jan	Feb.	Mar	Apr	Ma	Ju	Jul	Aug	Sep	Oct	Nov	Dec
1												
2												
3												
4												
30												

2. Pasture /Field Records

Planning Date	Crop	Variety	Seeding rate	Total Acre palnted	Area Planted

3. Harvest Records

Date	Crop	Yield and comments

4. Pasture Improvement Records

Date	Type of improvement	Description of improvement

Self-Check -1	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (5 pts each)

1. Explain the importance Record keeping and their types.
2. Explain the contents included in pasture improvement.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

_____

_____

_____

2._____

_____

_____

Information sheet 2	Disposing all waste and debris

Storing Waste material produced during work

Waste materials produced during treating crop residue activities should be identified, separated and stored safely for further processing. Plant debris like enset leaf, litter and broken components, plastic, metal and paper-based materials are wastes to be handled in treating crop residues.

Biodegradable waste materials such as plant debris should be separated from **none-biodegradable** one, such as plastics, and stored separately. These materials should be prepared and processed in an appropriate and safe manner. Plant debris can be used for the preparation of compost, one of the important soil components. Surplus west materials should be stockpiled for removal and safe disposal out of the pasture site after transporting seedlings to planting area. A clean and safe work site should be maintained while completing planting activities. These wastes can be recycled, re-used, returned to the manufacturer or disposed of according to enterprise work procedures. • Proper storing of crop residue When we store treated crop residue the condition should be air tight and should be used properly

Self-Check -2	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (5 pts each)

1. Explain the waste materials produced during pasture work for livestock.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

_____

_____

_____

Information sheet 3	Cleaning and servicing machinery and ancillary equipment

Because the object of farmers who practice good machinery management is to provide reliable service for their agricultural enterprises for the least cost, it is important to consider the various ways this can be done, including owning the equipment, using custom hire services, renting, sharing, or a combination of these options. Although most farmers prefer to own and operate their equipment, it can be very expensive to do all tasks with owned equipment.

Equipment Life

Properly maintained equipment will remain usable for many years. Poorly maintained equipment will wear out several years before well-maintained equipment. Preventive maintenance is time and money well spent. Think of your personal vehicle--if it is serviced regularly, it will last many years. This includes oil changes, removing road debris, and fixing a problem as soon as it arises. The same principle is true for farm equipment.

The operator's manual that comes with a new tractor will have recommendations as to the amount of hours between maintenance intervals.

When purchasing new equipment, ask the dealer to explain what types of oil to use for the different seasons of the year or what type of oil they recommend. Some tractor brands recommend their own brand of oils (engine and hydraulic oils and some require their grease) and any warranties will be void if they are not used. If this is the case with your brand, it is strongly recommended that you follow their guidelines. Ask the dealer to show you where the fittings are located and at what intervals to grease. This information is also available in the operator's manual.

When purchasing used equipment, you should ask the same questions. If purchasing privately, ask what brand of oils and grease are being used and try to

use the same brands. If purchasing a used tractor, also ask when the last oil change was and if the hour meter is working. Keep the same schedule as the previous owner. If purchasing used equipment, the same is true for where grease fittings are located and brand of grease.

Self-Check -3	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (5 pts each)

1. Explain the importance Machinery and material maintenance in relation to their life cycle.
2. Explain the questions asked while purchasing machinery in relation to their durability.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

_____

_____

_____

2._____

_____

Information sheet -4	Testing or sampling stored forage for quality

4.1. Why Should I Test Forages for Quality?

Greater net profit is the primary reason livestock producers need to know the quality of forages they are feeding. Not knowing the forage's exact quality acts as a two-edged sword that can cut into profits either way it swings.

Dairy producers who estimate the crude protein (CP) content of their haylage to be 2 percentage units lower than it is, and the crude protein content of their corn silage to be 1 percentage unit lower than it is, end up feeding more supplemental protein than necessary

Below are some of the terms used in quality analysis, what they mean, and how they are calculated.

Dry matter (DM) is the percentage of the forage that is not water. If a forage is 55% dry matter, then it has 45% water (100 − 55 = 45). Rations are balanced on a dry matter basis. Most laboratories will report results in two columns: "As Sampled" or "As Received" and "Dry Basis" or "Dry Matter Basis." Only values designated as "Dry Basis" can be compared across parameters. "As Sampled" values can be converted to "Dry Basis" by multiplying by the actual DM percentage.

Crude protein (CP) is a mixture of true protein and non-protein nitrogen, and also includes insoluble crude protein.

Adjusted crude protein (ACP), also referred to as degradable protein, is the amount of crude protein available to the animal for digestion. It is adjusted for the amount of bound or insoluble protein: ACP = CP − ICP.

Dry matter intake (DMI) is based on NDF concentration and is an estimate of the amount of forage an animal will consume. Feeding studies have shown that as percent NDF increases in forages, animals tend to consume less. Therefore, NDF can be used to estimate DMI. Use the following formula to estimate DMI: DMI (% of body weight) = 120 / NDF (% of DM).

Relative forage quality (RFQ) is a better index and estimate of actual forage quality than RFV, and better predicts how an animal will perform on a particular forage. It is

calculated from TDN and intake based on in vitro estimates of digestible fiber instead of ADF, which RFV uses. For convenience, index value ranges have been kept similar to those of RFV. It is considered a more fair method of setting hay prices for both buyer and seller. When both values are given, RFQ should be used. The analysis in Table 1 includes a 48-hr in vitro analysis of the NDF fraction, which allows RFQ to be calculated, next to RFV. Knowing RFQ helps explain unexpected milk response differences in dairy cows from apparently similar testing hays (based on RFV). The following formula is used to calculate RFQ:

RFQ = (DMI, % of body weight) * (TDN, % of DM) / 1.23

Self-Check -4	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (5 pts each)

1. Explain the importance knowing the forage quality.
2. Explain points to be understood in forage quality analysis.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

_____

_____

_____

2._____

_____

Information Sheet 5	Reporting environmental impacts of forage conservation activities

5.1. Environmental impact of pasture improvement

Improvements in grassland management which lead to better soil cover, reduction of erosion and maintenance of biodiversity are beneficial to the environment. Clearing of forest for installation of sown pasture, of doubtful sustainability, is very damaging and has been undertaken on a vast scale in recent years, in different countries. Many of the activities associated with improvement of natural grasslands, tree-felling, bush-clearing and over seeding, with or without fire are invasive and, especially on marginal land, require assessment of their overall, environmental effect and sustainability.

Problems with forage plant introductions

Demand for new, more productive, better quality forages is enormous. But some caution is relevant when considering the widespread introduction of potentially productive new forage species.

- Firstly, there is the danger of genetic erosion of existing adapted landraces.
- Secondly, some forages prove invasive in new habitats.

Invasive species

The ability to spread and colonies in a grazing situation was a desirable characteristic of pasture plants now such plants may be regarded as invasive aliens. For rotations, plants must be easy to extirpate at the end of the pasture phase. Among the worst weeds in agriculture are grasses, Elytrigia repens, Alopecurus myusuroides, Arrhenatherum elatiusvar. bulbosum; Avenafatua and A. ludoviciana are serious weeds in temperate crops.

Some grass weed species are also desired plants in grassland and fodder crop situations, e.g. Cenchrusciliaris, Chlorisgayana, Cynodondactylon, Panicummaximum, Paspalumdilatatum, Pennisetumclandestinum and Sorghumhalepense.

Imperatacylindrica is both a serious weed of crops and an invader of improved tropical pastures.

However, competition reduced growth of the indigenous species. Careful planning and thoughtful species selection is recommended before implementation of exotic large-scale afforestation programmes

Management should be sensitive to the needs of the ecosystem to ensure conservation of desirable species when native vegetation is supplanted by exotics

Self-Check -5	Written Test

Directions*:* Answer all the questions listed below. Use the Answer sheet provided in the next page. (5 pts each)

1. Explain newly introduced forage to a given environment.

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

_____

_____

_____

References

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2. https://aces.nmsu.edu/pubs/_circulars/CR641/
3. https://extension.psu.edu/forage-quality-testing-why-how-and-where
4. https://extension.psu.edu/forage-quality-and-testing
5. https://naldc.nal.usda.gov/download/48355/PDF

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