Animal Production

Level II

Learning Guide # 46

Unit of Competence: Participate in Forage Development

Module Title: Participating in Forage Development

LG Code: AGR APR2 M14 0919 LO1-46

TTLM Code: AGR APR2 TTLM 0919V1

LO3: Perform harvesting operations

Instruction Sheet	Learning Guide # 46

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

- Determining harvesting time and stage
- Storing harvested forage
- Determining utilization of developed 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 –

- determine harvesting time and stage
- store harvested forage
- determine utilization of developed 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 t 2 and Self-check 3” **in page - 5, 7 and 14** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” **in page - 15.**
6. Do the “LAP test” **in page – 15** (if you are ready).

Information sheet – 1	Determining harvesting time and stage

1.1. Effect of Stage Harvesting on Forage Quality and yield

Pasture quality (irrespective plant species) can be affected by the harvesting days of first date of cut and frequency of harvesting which consequently reduces the nutritive value. As pastures mature they are characterized by high content of fiber with a higher grade of lignification and low protein content. Most improved grasses fed at early stages of maturity are more digestible and are eaten in larger quantities than at more mature stages. Leaf to stem ratio is used as an index of quality, the quality of herbage depends on the proportions of stem and leaf in the particular plant species. Early harvesting had significantly higher leaf to stem ratio as compare late harvesting days. The leaf to stem ratio decreased as the plants advanced in maturity. The presence of an increased proportion of plant stems, typical of older plants, may restrict access to leafy parts and force animals to consume lower quality herbage. Digestibility of stem is much lower than leaf, digestibility of old grass is much lower than young grass while protein content also decreases as the plant ages, particularly in grasses. The aging of forage is frequently associated with a decrease in leafiness and an increase in stem to leaf ratio.

Stage of harvest influence the herbage dry matter yield, crude protein concentration and other chemical constituents. This suggests that there may be a physiological trigger, which leads to the increased production of stem material in tropical pastures. Changes in leaf number are themselves associated with changes in the number of internodes, and thus length of stems. Internodes length of elephant grass increased significantly with increased days of harvesting. Length of internodes per plant was affected significantly by harvesting days. Late harvesting significantly produced longer internodes as compared to early and intermediate harvestings.

Perennial grasses often live for relatively a few or several seasons by succession of secondary tillers, which replace the original tillers. However, annual grasses flower and die without producing replacement tillers which will be the reason for the death of the whole plant. Tiller number per plant of grass increased with increased days of harvesting. The yield and quality of grassland is significantly influenced by harvesting stages of grass.

1.2. Harvesting at the Right Stage of Maturity

Harvesting at the right stage of maturity is one way of enhancing crop residue yield and quality. Early harvesting immediately after physiological maturity of the crop was found to improve the crop residue yield and quality without adverse effects on the grain yield and quality.

Self-Check-1	Written Test

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

1. List conditions that indicate maturity time of forage. (3 points)
2. At what time forage harvested? (4 points)

Note: Satisfactory rating – 3 points unsatisfactory rating –below 3 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	Storing harvested forage

Proper Handling and Storage

Loss of leaves due to shattering, during harvesting, drying, transport, storage, and feeding of cereal crop residues to livestock feeding may be high due to the losses and inefficiencies associated with these operations. Straws and stovers should be stored only after they are dried to moisture content of less than 10-15%. Rain or moisture during harvest of straw can also cause fungal growth or loss of nutrients due to leaching prior to storage. In order to minimize spoilage, straws or Stover's should be stored in well ventilated sheds or in well-staked open heaps. In general, efforts should be made to minimize deterioration of the straw due to shattering of leaves, leaching and microbial attack during storage. Wastage should be minimized during feeding as well. Straws and stovers are offered on a feed trough or on a clean ground to minimize feed wastage due to trampling and soiling with dung.

Hay must be stored in a dry environment. Good quality hay should never be poorly stored. The type of storage may vary from area to area. A good stack of loose or baled hay will provide satisfactory storage in arid areas where there is little rainfall. More expensive shelters may be required for high rainfall areas. It is advisable to store hay by kinds and grades in case variable qualities are stored. Hay can also be stored by creating hay stacks. Stacks may be covered by plastic sheets to keep out rain. The surface layer of a stack may also be "thatched," in the same manner as a thatched roof to a house.

Hay of higher moisture content should not be stored because its nutritive value may be greatly lowered. It is generally the most convenient form of stored fodder and an appropriate forage conservation method for small-scale farmers and pastoralists with limited resources. Proper drying is essential so that the hay can be stored safely without heating excessively or becoming moldy. Maximum leafiness, green color, nutrient value and palatability can also be retained. The grass should be dried quickly and not unduly exposed to the sun to maintain these characteristics. Hay must be stored in a dry place. Hay can be bailed and stored under cover. Hay can also be store by creating hay stacks or hay store. These may be created in a field near the source, or close to where the hay will be required later in the year. Stacks may be covered by plastic sheets to keep out rains. The surface layer of a stack may also be thatched, in the same manner as a thatched roof to a house.

Self-Check -2	Written Test

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

1. In handling of developed forage, list cause of loss of forage leaves (4 points)
2. Is that possible to store hay without bailing? (5 points)
3. List materials that used for covering and stack making in hay storage (4 points)

Note: Satisfactory rating – 8 points unsatisfactory rating –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._____

3._____

Information sheet – 3	Determining utilization of developed forage

Systems of forage utilization fall into **two** major categories:

A. Immediate use

- ✓ Grazing
- ✓ green chop

B. Conserved forage

- ✓ standing hay
- ✓ hay
- ✓ silage

- The objective is to maximize the utilizable yield of the forage crop. In deciding the usage system, one has to consider the following:
- Type and persistence of the forage: Species with persistent and strong root systems are preferred for grazing while fast-regenerating and erect-growing ones are suitable for haying.
- Type of the farm enterprise: e.g., green chop/cut-and-carry systems are suitable for dairying and fattening.
- Potential maximum forage yield versus expected loss in the type of usage: If low herbage yield is expected for some reason, wastage due to conservation must be avoided, e.g., silage has the disadvantage of wastage compared with hay

3.1. Grazing

Grazing is the most common and the cheapest utilization method for both natural and sown pastures. In the case of sown pastures, prior to establishment, species have to be selected for palatability, accessibility, nutritive value and their ability to tiller profusely, resist defoliation and trampling, and respond to fertilization,.

Advantages

- ✓ Effective recycling of nutrients.
- ✓ Possible manipulation of transfer of nutrients from day grazed paddocks to night corrals via manure.
- ✓ Requires less labor and is less time-consuming
- ✓ Animals can select their diet in both quality and quantity.

Limitations of grazing

- ✓ Loss of material due to trampling, fecal contamination.
- ✓ Selective grazing.
- ✓ Early maturity, leading to stemmy stands
- ✓ Difficulty in clay soils, i.e., excessive plant damage and crusting.
- ✓ In some forage species, reduced content of soluble carbohydrates and subsequent production of toxicity of prussic acid (HCN), nitrite, and magnesium tetany is observed on cloudy days.
- ✓ Requires controlled grazing — fencing or shepherding.

Grazing capacity of native pastures

Grazing studies on native pastures at Holetta Research Center indicate that well-managed natural pastures could be stocked at 2 Tropical Livestock Units (TLU)/ha from July to end of December and 10 sheep/ha for year-round grazing with hay supplementation during the dry season. Cutting or grazing at 2-week intervals reduced total dry matter to about 50% of that obtained from a 4-week grazing interval, indicating that a rest period of at least 4 weeks was important.

3.2. Green chop/cut-and-carry system

Green chop is cutting green forage in the field and transporting it to the livestock (also called cut-and carry system). It is a common practice in areas where grazing land is limited, e.g., traditional feeding of tethered beef cattle in Hararghe (Eastern Ethiopia); thinned maize plants; garden weeds; chat (*Catha edulis*) leftover (‘*geraba*’), etc. A cut-and-carry system involving improved forages is more economical for commercial dairy farms and feedlot cattle finishers, and holds advantages for small ruminant feeding as well. When the green chop feeding operation aims to collect animal excreta in a confined space and return it to the land to build soil fertility, it is called *soilage*

Advantages of cut-and-carry system

- ✓ High recovery of plant material as it is not lost by trampling and contamination.

- ✓ Little selectivity because the system allows for rationing of animal intake.
- ✓ Feeding can be arranged at a convenient site.
- ✓ The excreta can be utilized as farm yard manure and applied where it is most required or composted.

Limitations of cut-and-carry system

- ✓ The continued removal of plant material could lead to deficiencies of soil nutrients, particularly potash.
- ✓ Requires high labor for cutting, chopping and transporting

3.1. Standing hay (deferred feed)

Deferred feed is the cheapest and easiest way of conserving forage, as it does not require machinery or physical handling. It is a common traditional practice in rural areas of Ethiopian highlands where certain village communities by common consent defer the bottomland communal grazing lands for use during the dry season. It is also practiced by large ranch holders and pastoralists in the drier areas.

Limitations

- ✓ High risk of fire hazard.
- ✓ Possible occurrence of light rainfall where the culms and leaves become moldy, called "blackening", making the standing hay useless as forage.

3.2. Stored fodder

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.

3.2.1. Hay

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. Hay should be made at the optimum date to maximize yield and still fulfill the nutrient needs of the livestock. It is best cut early in the flowering stage. When cut earlier, the nutritive value is higher but yield is lower and the moisture content is too high for easy curing. If cut after flowering, the increased yield does not compensate for decreased palatability and nutritive value. The first cut of hay from a crop is usually of better quality than subsequent cuttings.

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.

Factors influencing hay quality

- ✓ **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.
- ✓ **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.
- ✓ **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.

- ✓ **Foreign matter:** Indicates hay of low feeding value.
    - ❖ Injurious foreign matter, such as wire, stones, etc.
    - ❖ Poisonous plants, hard, bearded grasses etc.
- ✓ **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.
- ✓ **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.
- ✓ **Variety**: Refers to kind or variety. Legume hay is more valuable than grass hay of the same maturity condition and foreign-matter content.

3.2.2. Silage

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. A point of precaution in silage making is that it is not economically justified nor is there a special advantage to be gained in terms of animal nutrition by ensiling forages as long as the weather allows making good quality hay.

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

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.

Self-Check -3	Written Test

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

1. List methods of utilization of developed forage (4 points)
2. What are the disadvantages of cut and carry system? (3 point)
3. List advantage of making silage (3 points.)

Note: Satisfactory rating – 7 points unsatisfactory rating –below 7 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._____

Operation sheet -1	Procedures in harvesting time and stage of forage

Techniques to harvest forage as follows:-

Step 1: prepare materials for mowing

Step 2: mow at early stage

Step 3: mow/cut at dry time/day

Step 4: carryout wilting of harvested forage (if you use as hay)

Step 5: make ready for storage under roof that have cover

Step 6: protect risk factors like fire, pests, etc. from stack hay

Step 7: feed animals

LAP Test	Practical Demonstration

Task1; Determine harvesting time and stage

REFERENCE

Duguma Gemeda. 2010. Participatory definition of breeding objectives and implementation of community based sheep breeding programs in Ethiopia. PhD Thesis, University of Natural Resources and Life Sciences, Vienna, Austria.

Muhammad, R. 2016. Elephant grass as forage for ruminant animals. Department of Forage Crops and Grassland Management, Faculty of Animal Science, Hasanuddin University, Indonesia.