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TECHNICAL BULLETIN No.6
HOW TO MAKE AND CONSERVE HAY



ESGPIP

ETHIOPIA SHEEP AND GOAT PRODUCTIVITY IMPROVEMENT PROGRAM

Contact address:

Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP)

Telephone: +251 011 6180456/57

Fax: +251 011 6180458

Email: pvamrfethiopia@ethionet.et

P.O.Box: 15566 Addis Ababa, Ethiopia

FOREWORD

This Technical Bulletin titled “*How to make and conserve hay*” is produced by the Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP). The ESGPIP is a USAID funded Project with the objective of improving the productivity of Ethiopia’s sheep and goats.

The Technical Bulletin is intended to serve as an extension aid for Kebele Development Agents (KDA’s) to promote the conservation of the excess lush feed during the wet season for use during the dry season. It is believed that the information contained in this technical Bulletin will be transferred to Sheep and goat producers and help them to bridge the seasonal gap in feed supply. It will also be useful for other users engaged in the production of other types of ruminants.

At this juncture, I would like to thank all those involved in the preparation and review of this technical Bulletin.

Desta Hamito (Prof.)
Chief of Party
ESGPIP
August, 2007

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HOW TO MAKE AND CONSERVE HAY

Prepared By: Alemu Yami and Solomon Mengistu

Edited by: R.C. Merkel

1. Introduction

Ethiopian livestock producers are faced with wide seasonal fluctuations in the quantity and quality of livestock feed available. Green forage is available only at certain times of the year and stored fodder is important in bridging the gap in feed supply that occurs during dry seasons, droughts and when grazing land is scarce during the cropping season. Providing stored feed during these times is essential in improving sheep and goat production.

Hay is the most common and important conserved fodder used to maintain feed supplies throughout the year. Hay is produced by dehydrating green forage to a moisture content of 15% or less. It is generally the most convenient form of stored fodder and an appropriate forage conservation method for small-scale farmers and pastoralists with limited resources. Good quality hay is the cheapest form of feed during the dry season. Hay can be made by simple equipment, manually or with mechanization. Once correctly cured, hay is easy to transport and store. It can also be fed with little or no wastage. Hay making should be encouraged where climatic and economic conditions are suitable.

2. Types of hay

It is recommended that either a legume or a legume-grass mixture be grown for hay whenever feasible. This is because legumes are generally higher in protein than grasses and can have higher vitamin and mineral contents. Legumes, through *rhizobia* bacteria growing in nodules on their roots, take atmospheric nitrogen and use it for protein formation. While legume hay is preferred, most producers will produce a mixture of grasses and legumes for reasons of palatability, ease in curing, erosion control, etc. Hay can come from natural pastures or from areas of land planted with improved forages specifically for that purpose.

3. Characteristics of good quality hay

The feeding value of hay varies according to its quality. Hay quality is evaluated based on maturity, leafiness, color, foreign matter, and texture. A farmer needs to be acquainted with recognizable characteristics of hay that indicate high palatability and nutrient content. This is useful in buying hay or when preparing hay on the farm. The following are some characteristics of good quality hay.

- It is leafy, fine-stemmed, and adequately but not overly dry, thus, giving assurance of high protein content. The leaf-to-stem ratio should be high since two-thirds of the plant nutrients are in the leaves.
- It is bright green in color indicating proper curing, a high carotene or provitamin A content and good palatability. Brown hay indicates loss of nutrients due to excess water or heat damage.
- It is free from foreign material, such as weeds, stubble, etc.
- It is free from mold and dust. Musty, moldy, or dusty hay is not only unpalatable but can contribute to respiratory diseases.

- It is fine stemmed and pliable- not coarse, stiff and woody.
- It has a pleasing, fragrant aroma; it “smells” good enough to eat.

4. **How to produce good quality hay**

Follow the following steps to produce good quality hay:

4.1. **Harvest at an optimum stage of maturity**

This will provide a maximum yield of nutrients per unit of land and the highest digestibility. Stage of maturity is the most important factor that influences chemical composition and quality. The more immature the plant at harvesting, the higher the quality of the hay will be. This is primarily due to the proportion of leaf to stem. Hay quality decreases with advancing maturity. Most forage should be mowed just after reaching an early bloom stage of maturity. Time of cutting is, therefore, a compromise between quality and quantity of the harvested forage. The first cut of hay from a hay crop is usually of better quality than subsequent cuttings.

Big farms use mechanical harvesters that are tractor-mounted. Even small machinery is beyond the economic capacity of the subsistence farmer. The most widely used hand tool for harvesting is the sickle. The scythe is a more efficient hand tool for harvesting forage (Figure 1). The scythe can mow at about five times the speed of the sickle. Effective use of the scythe requires the following:

- A sward that is reasonably free from obstacles;
- A very sharp blade and regular sharpening throughout the day; and
- Some skill in its use.

On good, level, stone-free ground, about 500 m² can be mown per hour using a scythe. The scythe is not widely known or used in Ethiopia except in some areas near Addis Ababa such as Sululta and Holetta. In these areas the scythe (locally known as “falch”) is widely used to harvest natural pasture for making hay. The use of this tool should be promoted in other areas to facilitate faster harvesting of hay.

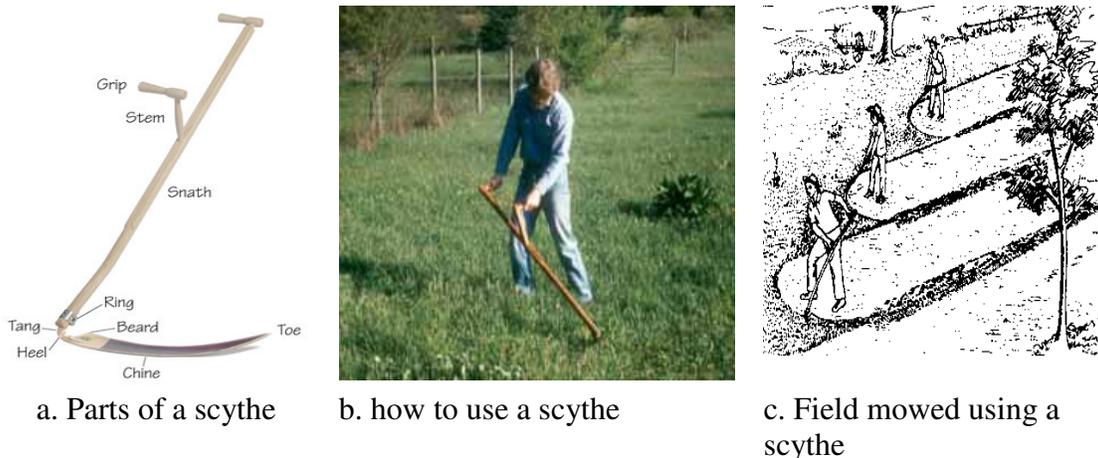


Figure 1. Mowing forage crop using a scythe

A scythe is used by holding the handles such that the blade is approximately parallel to the ground (with the heel nearly touching the ground) and, on completing the length of the field in question by walking in a straight line (Figure 1).

4.2. Proper drying

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.

Problems in haymaking vary according to the type of hay crop and prevailing weather at harvest. Slowness of drying is the major problem in sub-humid and humid conditions. Too rapid drying, shattering of the finer parts of the plant, and bleaching with consequent loss of carotene and vitamins are problems encountered under hot and dry conditions.

For drying hay under small scale conditions, place the material into small heaps about 20-30 cm high and turn the heap frequently in the sun to encourage quick drying. Turning should be completed before the forage is completely dry to avoid excessive shattering of leaves and overexposure to the sun. It is better if turning is done when wet with dew, especially when high leaf shattering is expected. If the weather is humid or rainy, facilitate drying by placing the cut material off the ground using a home-made tripod consisting of three poles (Figure 2).

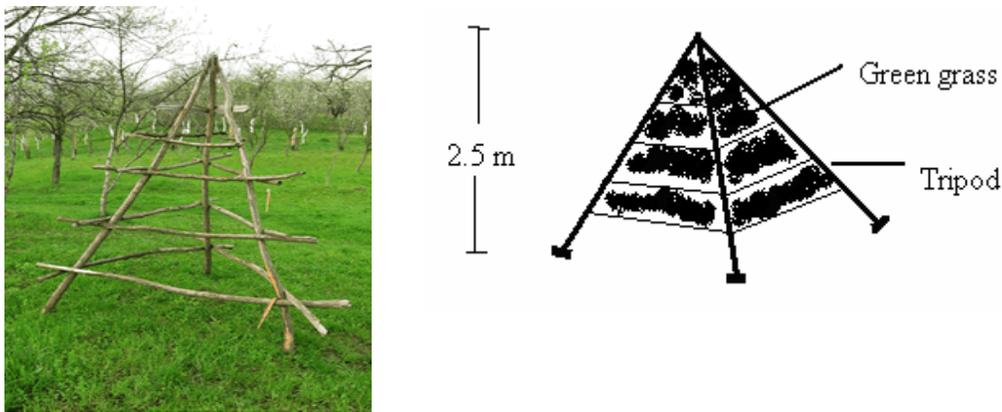


Figure 2. Hay drying tripod.

Freshly cut forage contains 75 to 80% moisture, whereas the maximum moisture content for safe hay storage is 25% for loose hay and 20% for baled hay. Hay of higher moisture content should not be stored because its nutritive value may be greatly lowered. Due consideration should be taken to avoid losses from the following causes during the curing of hay.

- *Shattering loss*: Leaves contain 2 to 3 times as much protein as stems. Leaves are also richer in carotene, B-vitamins, minerals, and energy. Legume forages contain a larger proportion of leaves than grasses. The fine leaves dry more rapidly than the coarse stems to which they are attached. This results in considerable shattering loss unless great care is taken.

In field cured hay, losses from leaf shattering range from 2 to 5% for grass hay and 3 to 39% for legume hays.

- *Bleaching and fermentation loss:* In general, the carotene or provitamin A content is proportional to a hay's greenness. With severe bleaching, more than 90% of the vitamin A potency may be destroyed. These losses will not be excessive with good weather and proper curing methods. Color loss is due to destruction of chlorophyll by sunlight.
- *Leaching loss:* This is the loss due to washing of nutrients by rain. Repeated showers are more damaging than one heavy rain. Leaching may lower the feeding value of hay by one-fourth to one-third or even more with severe exposure.
- *Spontaneous combustion:* Wet hay ferments and generates heat. This can result in spontaneous combustion and fire. This usually occurs about a month to six weeks after storing. Indicators of potential spontaneous combustion are hay that feels hot to the hands, a strong burning odor, and visible vapor.

Tropical pasture grasses generally take about 50-55 hours of drying in good weather and 70-75 hours in dull weather. The following two methods can be used to determine when hay is dry enough for storage:

- *The twist method:* twist a wisp of the hay in the hands. If the stems are slightly brittle and there is no evidence of moisture on the twisted stems, the hay is dry enough for safe storage.

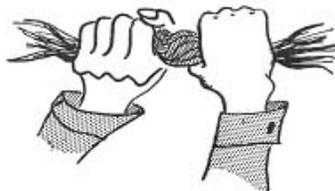


Figure 3. The twist method of checking dryness of hay

- *The scrape method:* Scrape the outside of the stems with the finger or thumb nail. If the epidermis can be peeled from the stem, the hay is not sufficiently cured. If the epidermis does not peel off, the hay is usually dry enough to store.

4.3 Store to protect from rain

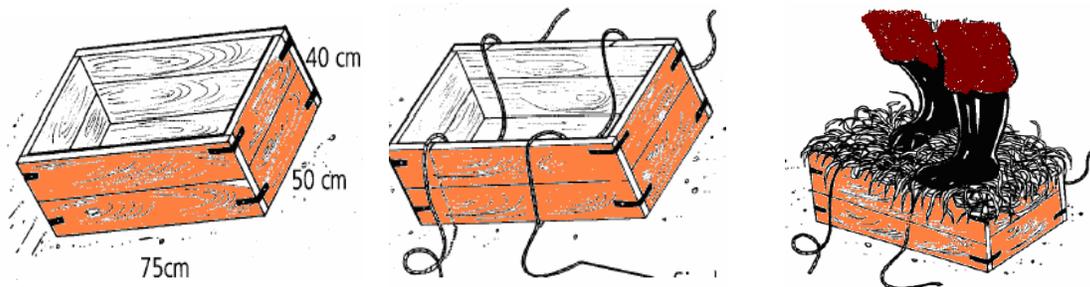
Hay must be stored in a dry environment. Good quality hay should never be poorly stored. The type of storage may vary from area to area. A good stack of loose or baled hay will provide satisfactory storage in arid areas where there is little rainfall. More expensive shelters may be required for high 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 stacks should be fairly compressed and loaf-shaped or conical shaped (Figure 4) to shed rainwater. It is advisable that the stack rests on a platform just above the ground. This provides air circulation and prevents the hay becoming wet from below.



Figure 4. Hay in carefully built and thatched stacks.

In areas with a long, severe dry season, tree legumes may lose their leaves during the driest period. These 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 leaf shattering. Tree legume branches should be cut and the leaves allowed to dry on the branch. They can then be easily stripped off and stored in a sack as a protein supplement for later feeding.

An alternative to stacking is to build and use a “baling box” to make tightly packed bales tied with strings (Figure 5). Baled hay is easier to handle and baling reduces wastage. Baling also reduces transport cost and storage space requirements by a third. Figure 5 shows the steps of baling roughages using a baling-box at a small farm level. This is a procedure even the smallest farmer can use.



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 5. Steps in baling roughages using a hay-box (Adapted from Massawe et al.).

5. Feeding hay to sheep and goats

Hay can be fed to sheep and goats, both of which are selective feeders. If enough hay is available, the sheep and goats should be fed excess, i.e., provide them with a greater total volume than they will eat. The sheep and goats will then select the most nutritious parts of the hay (the leaf) and will tend to leave the stems. They will gain more benefit from being able to select their feed in this way. The feed that they leave (the more stemmy part of the hay) can be fed to cattle. Hay is best fed on hay racks to reduce wastage (see Technical Bulletin No. 5, Feeding Management of Sheep and Goats).

6. Summary

Conservation of forage to bridge the gap in the supply and quality of fodder between wet and dry seasons is an applicable method of efficient utilization of feed resources. Preparation and storage of hay ensures the maintenance of nutritive value and minimizes wastage. The characteristics of good quality hay, procedures of producing good quality hay and proper methods of storage are described in this bulletin.

The Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP)

The Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP) is a USAID funded project operating with a goal to sustainably increase sheep and goat productivity in Ethiopia to consequently enhance economic and food securities. This will be achieved by addressing a large number of factors, including human and institutional capacity building, applied research and technology transfer and introduction of improved genotypes. The implementing institutions are the Prairie View A&M University (PVAMU), Prairie View, Texas and Langston University (LU), Langston, Oklahoma in collaboration with the Ministry of Agriculture and Rural development and other national and regional governmental institutions in Ethiopia. The project operates in six regions of Ethiopia namely Afar, Amhara, Oromia, Somali, Southern nations Nationalities and People's Regional state (SNNPRS) and Tigray. Project objectives will be attained through:

- Establishing a training program to upgrade knowledge of Kebele development Agents (KDAs) for more effective training of sheep and goat producers;
- Increasing effective use of available by-product feedstuffs to overcome shortages of feedstuffs for sheep and goats and elevate animal performance;
- Increasing employment of preferable alternative management practices for sheep and goats; and
- Introducing and evaluating improved genotypes of sheep and goats to elevate meat production and associated economic returns.