



# Principles of haymaking using tropical grasses and legumes

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## Why hay?

Hay is a very popular form of forage preservation that provides an important source of animal feed in smallholder farming systems where veld (natural rangeland) is increasingly limited. Commonly made from fresh grass, forage legumes—such as cowpeas (*Vigna anguiculata*), velvet bean (*Mucuna pruriens*) and lablab (*Lablab purpureus*)—can also be turned into hay. During haymaking, forage is harvested by cutting and is left to dry in the sun until the moisture content reaches about 20% dry matter, at which stage it is stored safely.

## Steps in haymaking

### Harvesting



Plants should be harvested by cutting at the appropriate stage of growth. As the plant matures, its herbage yield increases and nutritive value decreases. Therefore, hay should be harvested at a stage of growth when both the nutritive value (chiefly forage digestibility and protein content) and the herbage yield are optimized—usually at flowering time.

### Timing

Forage intended for making hay should be harvested when the farmer is confident there will be three or more days of sunny weather. Harvesting is best done in the morning, to allow the cut forage to start drying during the remaining part of the day when the stomata (tiny breathing holes on leaf surface) are still open. When the stomata close—which occurs a few hours after cutting—the drying rate decreases.

Herbage does not die immediately after cutting. It continues to live (or respire) until its normal metabolic processes are halted by lack of moisture. While it is alive, the herbage continues to lose nutrients from within the plant cells. Therefore, it is important that the herbage is dried as quickly as possible to preserve the herbage's nutritive quality.

### Cutting



Resource-constrained farmers can use hand-held sickles (or slashers) to cut grass and legume crops. Where resources permit, tractor mounted mowers can also be used to harvest the pastures.



### Conditioning

Leaf and stem material is normally covered with wax-like material (cuticle) on its skin (epidermis), to protect the plant from unwanted water loss. Water lost as by transpiration occurs through the stomatal apertures. To hasten drying, forage can be physically treated at the moment of cutting or immediately afterwards. The objective of such treatment is to bruise or press the herbage so as to break the skin and its cuticle and, thus, avoid stomatal resistance during drying. This can be achieved by putting the forage on a hard surface and rolling a 200 litre steel drum, covered in mesh wire, over it.

### Turning



Cut and conditioned herbage must then be turned several times to speed up the rate of drying. The process of turning the hay softens it up and allows the air and sunshine to penetrate the herbage, hastening drying. Turning must be done once or twice a day. However, if the hay is turned too frequently, particularly when it is almost dry, will cause the leaves to shatter (and break into pieces). Legume hay is especially prone to leaf shatter.

### Baling

Baling hay too early (when moisture levels are greater than 23%) will trap moisture inside the bale and promote the growth of thermophilic

bacteria, causing spoilage from heating and even burning of the haystack. Late baling (when moisture levels are around 15–16%) will cause the leaves to shatter, due to extreme dryness. The ideal moisture content for baling varies from 18–22%, depending on forage species. In the absence of a baling machine, using their feet, smallholder farmers can compress the hay in portable wooden crates or pits—90cm long x 60cm wide x 60cm deep—dug into the ground.



### Storage

Proper storage is a critical step in making high-quality hay. Hay bales should be stored in well-ventilated farm sheds that also provide sufficient cover from the rain. It is important to ensure that the sheds or barns do not expose the hay to very moist conditions causing spoilage from mould. Hay sheds can be built using simple materials, such as wooden poles and grass thatching. Wooden pallets or a raised platform can be used to avoid placing the hay directly on the shed floor, as shown in the picture.



## Field losses and quality changes

Serious losses in dry matter quantities and nutritive value can occur during haymaking. These should be minimized to ensure profitability. Losses in the haymaking process can occur in the following ways:

### *Respiration losses*

As already indicated, harvested forage will continue to breathe after cutting, causing loss of dry matter as nutrients are expended. Therefore, drying should be done as quickly as possible to minimize losses. Under normal conditions, losses may amount to 1–5% of total dry matter yield.

### *Leaching of nutrients*

The leaching of nutrients occurs when rain falls on cut herbage before it can be dried or stored away. For best results, the hay crop should be

dried in dry and sunny conditions. Farmers should use their experience of weather condition or information from weather forecasts to determine the best time to cut hay as losses caused by rainfall damage can be as high as 15% of total dry matter.

### *Mechanical losses*

In smallholder farms mechanical losses are minimal because farmers use simple equipment, such as sickles, to cut herbage and the area covered per day is relatively small, such that most of the cut forage is picked-up by hand. In mechanized operations, losses can occur as crops are not picked up by the machinery—either at harvesting or baling. This usually happens when chop length (the average length of the cut hay) is too small, making it difficult for the machine to pick it up. This can also occur when the mower, rake or baler is not in good working order.



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