



## Principles of silage making in the subtropics

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### What is silage?



Silage is fodder developed from fresh herbage containing sufficient water soluble sugar content (WSC) and fermented in 'air tight' (or anaerobic) conditions until enough acidity to keep the forage from rotting is produced by sugar-fermenting (epiphytic) bacteria that occur naturally on the surface of the forage. The desirable epiphytic bacteria (predominantly the lactic acid type) convert the WSC in the plant material into pleasant smelling lactic acid (LA), preventing spoilage of silage by other bacteria or moulds (fungi). Ideally, forage should have WSC concentration of 13–16% of dry matter before ensilage. Incorrectly fermented silage is dominated by butyric acid, which smells badly and makes silage unpalatable and toxic.

Good quality silage must meet the following standards: pH < 3.9–4.2, dry matter with LA of 3–13%, butyric acid < 0.2% (v/v%), ammonia nitrogen (NH<sub>3</sub>-N) < 1% of total N content. However, pre-wilted grass silage can be preserved at higher pH (4.5–4.7), a lower LA content, and LA:acetic-acid ratio. Good preservation of legumes require the application of supplementary WSC.

### The importance of silage



Owing to the seasonal nature of rainfall in the subtropics, rangeland and planted pasture only supply high-quality green forage for a quarter of the year, leaving animals to struggle with poor-quality forage for the rest of the year. On a high producing farm, there is need to conserve high-quality forage in large quantities, sufficient to last 5–6 months of the dry season. Silage provides a means to conserve forage in as near a form to the original forage as possible. Due to the high production costs, it is mostly used in highly profitably enterprises, e.g. dairying.

### Method

Forage used in silage making is chopped to small pieces (ideally 15–25mm long) so as to expose as much plant sugar as possible to fermentation bacteria. Then, it is placed in a silo and compacted (i.e. packed together) so that as much air as possible is driven out to create anaerobic conditions. Exclusion of air also helps to ensure the plant material does not continue to breathe/live. Harvesting, chopping and compacting has to be done very quickly and the silo sealed

immediately so as to avoid losses of water-soluble sugars that are fermented by the lactic

acid bacteria. The silo can be a pit covered with plastic sheeting, a drum or a plastic bag.



For financial reasons, forage species with a high yield per unit area, such as maize, sorghum and Napier grass, are normally used to make silage. Cereal crops, such as maize and sorghum, should be harvested at milk dough stage, and Napier grass at 6–8 weeks, when its WSC content is highest. Other crops, such as Lablab purpureus and velvet bean (*Mucuna pruriens*), should be ensiled (preserved in a silo) at flowering stage to ensure optimum nutritive value of the silage.

#### *Bag silo*

Farmers can use plastic bags capable of holding 15–25kg of chopped forage. The chopped forage is sealed in the bag, after being compacted, so as to exclude the air and retain all the products (acids) of fermentation. Bagged silage is often preferred to pit silo, as it reduces the hard work of digging out

the silage at feeding time. Small bags are also both easier to store and portable. Putting the silage in small bags avoids exposing large silage surfaces to aerobic spoilage because leftover silage is quickly spoiled once the bag is opened.



## Pit silo



This involves digging a pit in the ground. On smallholder farms with one or two cows, the pit should be 2m deep, 1.5m wide and 3m long with one end slopping to allow easy entry and exit, while loading and offloading the pit. The farmer should ensure that 400–450 kg of plant material are compacted in every 1 m<sup>3</sup>. Thus a pit of this size will store 4–5 tonnes of silage.

The silage can be compacted by rolling a 200 litre drum (filled with water) over each 10–20cm layer of herbage, during silo-filling.

It is important to ensure that the pit is dug where the water table is low, e.g. on an upward slope. The sidewalls of the pit should slope slightly inwards towards the bottom so that settling of the silage will not produce air pockets at the sides, which causes spoilage. The side of the pit must be completely smooth with no rocky outcrops or bumps.

The pit must be filled as quickly as possible and sealed with plastic sheeting, flowing over the edges of the pit on all sides so as to avoid rainwater damage. A thin (30cm) layer of soil can be spread over the sheet to protect the plastic sheet and the ensiled crop.

## Storage

### Bagged silage

Ideally, bags of silage should be stored in a room near the milking parlour or feed troughs. The room should be sealed from rodents and insects that could puncture the bags. Every year before ensiling begins, the room should be checked to ensure it is free of rodents and other factors which may compromise the safe storage of the silage bags.



The surface area selected for the storage of silage bags has a big impact on silage quality and ease of which the animals can be fed. Concrete padding provides an excellent surface for silage bags. Little or no damage is caused to the silage, as it can be easily removed from the bags. Having concrete padding also helps the drainage of water away from the bags, deters pests and facilitates the inspection of damaged bags.

Compacted gravel surfaces are also ideal for placing silage bags as they make weed and pest control easy—as long as they is good drainage.

### Pit silos

The siting of a pit is crucial to safe storage. A proper pit site is one which has good drainage so as to avoid soil moisture from contaminating the silage and leading to decomposition. The pit also needs to be well covered—with plastic sheeting—after being filled. This enables the water to run off in the event of rainfall. Silage is normally ready to be used as feed after 2–3 months of fermentation.

When opening the pit, care should be taken so as to expose as little of the surface area as possible to elements of the weather. The exposed areas should be covered immediately after the daily ration of silage has been collected so as to minimize spoilage.

### Other benefits of silage

Silage can also be used to improve the body condition of high-value beef cattle in market-oriented production systems, so as to obtain higher market prices.



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