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Silage in the Top End

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INTRODUCTION

Fodder conservation in times of abundance during the wet season can overcome feed shortages in the mid to late dry season and allow for increased animal production. Large quantities of high quality crops and pastures are available in the mid to late wet season but unpredictable rains and high humidity limit the potential for hay making at this time. As weather conditions for silage making are less critical than for hay making, silage can be made at this time with few risks.

PRODUCTION OF SILAGE

Silages are made from cut forage, slashed and chopped with a forage harvester or cut with a mower conditioner and then raked into windrows, and may be wilted.

Good quality maize silage

Harvested plant material is stored under anaerobic conditions where air is excluded. This allows the desired fermentation processes to occur and preserves the material with minimal loss of nutrients. Good silage can be made from improved pastures (gamba grass, pangola grass and Wynn cassia have been used successfully in the Top End), forage crops (e.g. sorghum or millet), crops such as maize grown specifically for making silage or failed grain crops of maize or sorghum.

The quality of the material at harvest, treatment of cut material prior to ensiling and the storage conditions determine the quality of the silage made. Good silage is the result of well compacted material, eliminating air and then effectively sealing the stored material. Silage will spoil if air is left in the material or regains entry.

THE FERMENTATION PROCESS

Two processes occur in the formation of silage.

Phase One

Residual oxygen trapped in the compacted forage is quickly used up by aerobic microflora (i.e. bacteria and fungi). They break down plant components, producing heat, water and carbon dioxide. If phase one is extended because of bad compaction or poor sealing, large losses of plant nutrients, particularly energy rich carbohydrates will occur.

Phase Two

As residual oxygen is used up in phase one, anaerobic bacteria break down plant carbohydrates and sugars to produce acids. Plant proteins are also degraded to organic acids and ammonia. Acidity increases as fermentation proceeds until a stable pH is reached.

QUALITY

Good quality silage is moist but not wet, has a clean sweet acid smell and stock find it palatable.

The commonest type of silage is characterised by high lactic acid content and a low pH of about 4. Under tropical conditions, high levels of acetic acid may form in the silage with a pH of about 5. Wet conditions can promote the dominance of clostridial bacteria which produce large amounts of butyric acid and a silage pH of 5-7. Silage that has undergone a poor fermentation process will smell rotten or sour and stock will often not eat it. Such silage is also of a much lower nutritive value when compared with the original forage. Overheating during Phase 1 may cause protein degradation resulting in poorer quality silage. However, such silage often has a very sweet caramel smell, which stock generally find highly palatable.

FACTORS AFFECTING QUALITY

Cutting Time

Plant material should be cut pre-flowering which is generally in the mid to late wet season (March-April) in the Top End. This ensures both maximum yield and a high nutritional quality. In good early rainfall years, plant material may be cut earlier for ensiling.

Moisture Content

The plant material should be ensiled at 30-35% dry matter (65-70% moisture). If the material is too dry, compaction will be difficult and pockets of air will remain within the silage resulting in poor fermentation. Material which has too high a moisture content will promote the growth of undesirable clostridial bacteria and may have seepage problems causing loss of nutrients.

Wilting

Wilting is commonly used to reduce the moisture content in the forage. This concentrates the sugars needed for 'good' fermentation. It helps promote the growth of lactic acid bacteria over the clostridial bacteria, allowing a rapid increase in acidity to produce stable silage. Deliberate wilting is probably desirable, depending on conditions, particularly where moisture content is high, or if silage is being made early in the wet season.

Chopping

Chopping forage to smaller lengths will allow better compaction of the silage and earlier release of plant sugars which encourages faster fermentation and earlier stabilisation of the silage. The use of a double chop forage harvester can be an advantage. The most suitable chop length is a function of the moisture content. The drier the material, the smaller is the chop length needed, that is longer chop lengths of 15-17 cm for 30% dry matter content, down to 5-7 cm for 40-50% dry matter content.

Additives

A 'good' fermentation relies on adequate levels of plant sugars. Forage low in plant sugars may require the addition of a sugar-rich material such as molasses to ensure optimum conditions. Molasses should be added at a rate of 8% or more (by weight). Too little can be worse than none at all, because sugars may be exhausted before acidity levels stabilise in the silage, resulting in a poor silage.

Also available are "silage inoculants" of the bacteria, "lactobacillus" (the lactic acid producing organisms). A reduction in losses of nutrients as a result of inoculants has not been confirmed in the NT.

When feeding silage out to livestock, supplements (such as urea, salt etc.) may be provided if additives have not previously been incorporated.

Storage

Silage should remain sealed until it is fed out as exposure to air causes it to decompose. Silage can be stored in many ways, including in trenches or pits below ground and above ground in bunkers, silos, round bales, stacks or sealed containers.

Site

When choosing a site, consideration must be given to:

- Distance between the source of raw material and livestock to be fed to allow easy access to livestock for feeding, or machinery for handling and transport.
- Prevention of flooding and allowance for adequate drainage.
- Protection from birds, vermin and stock.
- The length of time the silage may be stored (underground storage may reduce the chances of weathering).

METHODS OF STORAGE

Round Bale Silage

A round baler is used to make 400-600 kg bales which should be transported to the storage site without delay. They are wrapped individually with plastic film using a wrapping machine, taking care to adequately overlap the plastic. Alternatively they can be placed in individual bags, or placed end to end in long, sausage shaped rolls and the plastic wrapped over the top and held firmly in place and the ends sealed off.

Variations in stacking can be used such as pyramid stacked rolls. Remember that less the surface area, the less is the chance for spoilage from exposure to oxygen from the air. Stacking also increases the pressure (compaction) and reduces the surface area exposed to air, vermin and birds. The storage area should be well cleared, preferably of a concrete surface, before wrapping and stacking, to ensure that the plastic wrap is not punctured by sticks or stones. Termites are a problem with baled silage set on bare ground.

With careful preparation and handling, individually wrapped bales can be transported to feed livestock in remote areas.

Pit Storage

An ideal storage bed for silage can be found at the lower slope of a hillside. Precautions should be taken to ensure flooding or water logging cannot occur in the pit. Raised water tables in the wet season should also be considered when siting a silage pit. When compacting material with a tractor, care must be taken to minimise contamination of the forage with soil from tyres as this can promote an undesirable fermentation and sour silage. Compaction by tractor can be increased by using ballast weights, thin tyres and filling the tyres with water.

Long, deep, narrow pits are recommended because they are easier to fill and compact progressively and they minimise exposure to air when feeding out. The silage face must be resealed as quickly and as tightly as possible after feeding to reduce exposure to the air.

Once an area has been established as satisfactory for silage storage it can be lined with plastic sheeting, gravel, or ideally concrete. Concrete is the best surface, due to reduced contamination from air and soil and to reduce wastage when feeding out.

Bunkers

Earth bunkers can be pushed up on flat land, but the floor should be raised and slightly sloped (2 to 3 %) to promote drainage. Much the same precautions must be used for this type of silage as for pit silage.

Plastic sheeting over the top can be covered with tyres or soil to seal the silage and reduce the possibility of damage by birds, rodents, reptiles etc. Use subsoil where possible as the topsoil may contain ants or other insects which chew holes in the plastic.

Filling a silage bunker

Clamps

Concrete or steel-sided silage clamps are suitable for storage. These materials reduce the contamination from soil and make retrieval easier. Steel needs to be protected with epoxy bitumen or a similar coating to prevent corrosion by the silage acids. Steel sides can be constructed from angle iron frame and steel plate. Concrete walls can be block construction with filled cores and reinforcing rods or purpose built prestressed modules.

This type of storage is ideal for feeding out on-site as a feeding gate for stock can be placed in front of the silage, suspended from the walls and moved along a clamp as the stock consume silage at the face. This eliminates damage to the clamp by preventing stock from walking all over it and reduces wastage by trampling and faecal contamination.

Silos

For large silage users, tall airtight tower silos may be used. Fresh material is added to the top and the fed material is removed from the bottom. These structures are generally quite expensive and need a big operation to justify the cost.

Above Ground Mounds

These can be constructed on concrete pads or hard pan areas where there is no possibility of flooding. They consist of a bun shaped mound compacted from all sides. Small buns have large air to surface ratios, so are inefficient. This method is suitable for large quantities where the surface area to tonnage ratio can be reduced. Heavy compaction is the key to success. A large air-tight cover may be useful in shedding water and keeping the silage fresh in the early stages of construction of the mound, or if compaction is not sufficient to stop respiration in the mound.

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