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PROVINCE OF KWAZULU-NATAL

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Grass Silage

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Pannar Seeds

In areas where the winters are usually cold and dry the conservation of forages is essential for good livestock farming. Forages are conserved in the form of hay, silage, foggage, and spared veld, and all these types of stored feed may complement one another. Some farmers, however, tool up for either haymaking or silage making, owing to high capital expense, but many farmers have sufficient machinery on hand to do both operations.

Some farmers may ask why one should make silage, rather than hay, from pasture. There is something to be said for both forms of conserved forage, so let us consider some of the advantages and disadvantages of making silage, rather than hay, from pastures.

ADVANTAGES

- Silage-making is less dependent on the weather.
- There is less bleaching by the sun with a consequent loss of carotene (vitamin A).
- Bulky pastures can be ensiled easily, but not so easily made into hay.
- There is no fire hazard.
- Silage is better as a fodder bank because hay oxidizes during storage.

DISADVANTAGES

- There is a lower intake of dry matter (DM).
- Transportation and storage costs are higher.
- Hay is more acceptable to young livestock.

Other comparisons could be made to show that pasture silage has a role to play in comparison with maize silage.

Maize is still the crop most widely used for silage in South Africa, but it could be argued that maize now, and in the future, will be grown more for grain production, both for human and non-ruminant consumption, and that only the residue (stover) will be used for ruminant animal production. The alternative would then be pastures, particularly perennial pastures for silage, because perennial pastures are cheaper to grow than are annual crops.

Some other factors to consider when comparing pasture silage and maize silage are the following:

- Costs per kg DM and per kg digestible nutrients are similar.
- Costs per kg crude protein (CP) favour pasture silage.
- The maize crop is vulnerable to hail and weeds.
- The pasture usually would have to be cut three times to obtain the same tonnage as one cut of maize.
- Pasture silage is made during the rainy season with a risk of in-silo losses if the silo is not sealed correctly. On the other hand, in the summer rainfall areas, maize silage is made when the rainy season is almost over.

PASTURE SILAGE

Pasture silage-making is a compromise between quality and quantity, *i.e.*, between one heavy cut late in the season of relatively poor quality material, or more smaller cuts taken from younger material of relatively good quality, but with a lower total yield over the season.

Silage is usually made from seasonal surpluses which otherwise might have been wasted. Removing these surpluses also has advantages to both animal production and pasture management, because taking a silage, or hay, cut from a pasture will:

- Reduce high potash levels created under intensive conditions (high potash levels adversely affect animal metabolism).
- Ensure a succession of swards which are at the right stage, in terms of quality, for grazing.
- Reduce waste due to fouling of pastures under continuous grazing.

Plan the silage operation

It is necessary to know how much silage you will need, and then to plan for an area to be closed off to meet this requirement. The amount of silage needed is calculated from the overall fodder plan. The area required to meet this silage need is calculated from the expected pasture yields, determined by growth curves and management practices (including fertilization). The quality of the silage can be estimated from the stage of growth at harvesting.

The silo space that is required to accommodate this yield is very simply calculated from the known density of well-compacted pasture silage *viz.* 1,4 m^3/t of 30% DM silage (or 650 to 700 kg silage/m^3). There are four common types of silo in use in South Africa. They are the following:

Tower silos

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Clamp or stack silos

No structure is necessary. The silage is simply dumped on a convenient patch of ground to a height of at least 2,0 m and, ideally, is sealed within 1 day, or a maximum of 3 days. It is important that it is well sealed with black polythene, which, in turn, is covered with old tyres to prevent it from flapping in the wind. The area round the clamp must be drained.

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Trench or pit silos

These are lined with either brick or concrete, or have earthen walls. Since it is difficult to prevent rain from entering, they usually have a drainage problem. They are not very satisfactory for pasture silage.

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Bunker or walled-surface silos

These are most suited to pasture silage and, if possible, they should be made to be portable. They should have sides that slope outwards slightly, and a minimum width of 3 m at the bottom. For practical purposes, a 4 m width is most satisfactory. A width greater than this would make the silo difficult to fill rapidly for quick sealing.

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Machinery requirements are discussed in a later section, but it is important to plan the most suitable system, and then to obtain the machinery to carry out the operation. Furthermore, as with haymaking, ensure the machinery is in good order before the season starts, since one cannot afford to have a breakdown once the silage-making operation has begun.

Species

In the summer rainfall areas, where pastures are grown intensively, surpluses of forage can be expected during spring and mid-summer. Spring surpluses occur when temperate species such as the ryegrasses, tall fescue, cocksfoot and clover reach a peak in their growth curves, and when sub-tropical species are commencing their growth, usually about October.

Mid-summer surpluses occur when sub-tropical species such as kikuyu, coastcross 2, stargrass and paspalum reach a peak of growth, usually about January to mid-February.

The temperate species are higher in soluble carbohydrates than are the sub-tropicals, and therefore make better silage which can be made without additives. Legumes such as clovers and lucerne are low in soluble carbohydrates, and therefore these should be ensiled with an additive, preferably a carbohydrate such as molasses. Well-made legume silage results in better intakes by livestock, and has a higher protein content than grass silage. Legumes therefore are often mixed with grass.

Although *Eragrostis curvula* is essentially a hay grass, and produces only a medium-quality silage, it is sometimes expedient to make silage, rather than poor quality hay, when the weather is inclement.

Time to cut

The longer the pasture is left before cutting, the poorer the quality, although a greater bulk of material is harvested. It is preferable to sacrifice quantity for quality, but this would depend largely on what class of livestock is to receive the silage. The following are some guidelines to determine the time of cutting for some of the more important pasture species, together with expected yields. It is assumed that fertilization is sufficient to achieve these yields. Suggested rates of fertilization are given in a later section.

- Kikuyu, coastcross 2, stargrass and paspalum pastures that are harvested at 5 weeks of growth would yield up to 3,5 t DM, or 11,6 t 30% DM silage, per ha.
- Ryegrass, cocksfoot and tall fescue pastures that are harvested after 5 weeks of growth would yield more than 2,9 t DM, or 9,6 t 30% DM silage, per ha.
- *Eragrostis curvula* at the hay stage would yield up to 3,2 t DM, or 10,6 t 30% DM silage, per ha.
- Irrigated lucerne at about 10% flowering would yield 2,5 t DM, or 8,3 t 30% DM silage, per ha.

Note: The ryegrass would be under irrigation, and the other pastures would attain these yields in areas where the mean annual rainfall is greater than 800 mm p.a.

The more mature the pasture, the higher the DM content of the green material. Mature pasture may be direct-chopped without prior wilting, as the DM content would already be up to 25% or more. Young, high-quality pastures containing about 15% DM should first be wilted, or, if they have to be direct-chopped, an additive must be used, but losses will occur in the effluent.

Fertilization

Having decided on an area from which to make silage, the full potential of the pasture growing there should be exploited to justify the expense of making the silage. This potential can be realized by correct fertilization.

The base fertility status of the soil should be corrected if a soil test shows it to be necessary. Nitrogen (N) is the most important plant nutrient, with a linear DM yield response to nitrogen fertilizer applications up to a rate of 450 kg N/ha/annum and more, by both kikuyu and Italian ryegrass, but this response depends largely on site, soil,

and, particularly, availability of moisture. The timing of the N applications is important. Smaller quantities, applied often, result in more efficient use of the N than does one application in the spring. Usually between 60 and 75 kg N/ha per dressing are applied. Apply 75 kg N/ha when the pasture is closed off for silage.

Potassium (K) is the second most important plant nutrient for pastures wherever the material is removed in the form of silage or hay. When the grazing animal is excluded from a pasture, and either silage, or hay, is made from it, then 1 kg of K should be applied for every 2 kg of N applied. In this same situation, phosphate (P) should be replaced at a rate of about 32 kg P/ha/annum.

Requirements for making good pasture silage

- Exploit the full potential of the pasture by fertilization for optimal production.
- Before closing off a pasture for silage, graze it heavily or remove any build-up of old herbage material by other means, to ensure that the new growth is of high quality.
- Topdress with N after herbage removal at closing off.
- Although some field losses will occur, most pastures should be wilted to 30 to 35% DM content. The in-silo losses that occur with wetter material are far greater than the field losses. Most pastures cut at the right stage for optimum quality contain about 15% DM. On a hot day the rate of drying will be such that the DM increases about 3 to 4% hour. This means that one should allow a 3 to 4 hour wilting period from October to February, and about a full day's wilting period for other times of the year.
- Pasture that is chopped into short lengths (< 2,5 cm) when ensiling, is easy to compact and easy to feed out.
- Plan to fill the silo as soon as possible. The Dorset wedge, a system of loading silos where a wedge is formed and the silo filled with consecutive layers on the wedge, is recommended for bunker silos. This ensures that at least one metre of new fill covers the previous day's fill.
- If the silage material is wet (15 to 28% DM), compaction need not be immediate, but good compaction is necessary, particularly on dry material, to control temperature and exclude air. High temperatures are the result of respiration due to the presence of air, which also promotes mould growth. These two factors are the biggest cause of in-silo losses.
- Cover each day's fill with polythene sheeting to reduce air movement.
- Seal the silage within 3 days. Fermentation takes 3 to 6 weeks. Access of water or air after fermentation destroys preserving acids and allows fungal development and secondary fermentation to take place.

Additives

Use additives where necessary. For cold fermentation silage, *i.e.* less than 98 ° F or 36 ° C (normally a direct-chop, wet silage), use formic acid or formaldehyde based commercially available preservatives. For

warm fermentation silage, *i.e.* greater than 110 ° F or 43 ° C, use commercial proprietary preparations, containing sulphuric, propionic or hydrochloric acids. The silage material in this case would contain more than 40% DM, *i.e.* a dry silage sometimes called haylage. Legumes, and some grasses that are low in soluble carbohydrate (less than 10%), will require a carbohydrate additive such as molasses.

Bacterial inoculants, available commercially with or without enzymes, and sodium metabisulphite (5 g/kg fresh weight) are also used as additives with varying degrees of success.

Pastures high in soluble carbohydrate (>12%), and wilted to 30 to 35% DM (65% to 70% moisture), do not require any additives.

Sealing the silage

Probably the most effective way of sealing the silage is by using a sheet of black polythene, 250 microns thick, which is spread over the top of the silage and gullied at the sides to prevent rainwater from entering. Allowance must be made for shrinkage by building up a crown in the centre of the silo. The sheeting then should be covered by old motor car tyres, touching each other, to prevent the plastic from billowing, and to help the silage to settle.

There are other methods which may be used to seal the silage, such as a covering of old hay which, in turn, is covered with about 15 cm of soil. The main disadvantages of this method is the possibility of soil contamination and problems of removing the soil when the time comes to feed out.

Opened-up fertilizer bags (covered with old tyres) have sometimes been used, but this practice results in a great deal of wastage, because the seal is inefficient.

Characteristics of good pasture silage

Physical signs of good pasture silage are that it has a pleasant aroma, a slightly acid and fruity flavour, and the smell does not linger on one's hand after having handled the silage. It will be pale green in colour.

Other characteristics are:

- DM in the silage is 30 to 35%
- pH is 4,0 to 4,5 (temperate grasses)
- lactic acid content is greater than 5% of the wet material (unwilted temperate grasses).
- acetic acid content about 3% of the wet material.
- no butyric acid.
- density is approximately 1,4 m^3/ton.
- fermentation temperature is 100 to 110 ° F, or 38 to 43 ° C.
- water soluble carbohydrate content of the green material is 12 to 18%.

Silage-making equipment

Good silage can be made with any forage harvesting equipment varying from self-loading wagons to the largest, self-propelled precision-chop machines, provided that the principles of good silage making are understood. Good after-sales service, and availability of spare parts, are essential, because silage-making machinery is relatively complex and expensive.

Three possible combinations of machinery, together with the workrate of each, are shown below.

System No. 1: for wilted high quality pasture

- 3 to 4 tractors, depending on distance from the silo
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- 2 reciprocating mowers (1,8 m), or 1 mower conditioner (2,7 m)
- 1 side-delivery rake (optional)
- 1 precision-chop forage harvester with an interchangeable head which could also be used for row crops
- 2 high-sided tip trailers (the sides should be wider apart at the delivery end to allow the cut pasture to slide off easily)
- 1 buckrake, or front end loader, to spread the cut pasture in the bunker

Workrate = 4 ha/10-hour day, ensiling 43 t of 30% DM silage.

System No. 2: for more mature pasture or pasture with additives, direct chopped

- 3 to 4 tractors (as above)
- 1 forage harvester (flail or double chop)
- 2 high-sided trailers (as above)
- 1 buckrake or front end loader (as above)

Workrate = 7,3 ha/10-hour day, ensiling 80 t of 20% DM silage.

System No. 3: for big bale silage.

Where big bale hay is already being made, and where, in a good year when surpluses occur, small quantities of silage can be made in addition to the main silage programme.

- 2 tractors
- 1 mower conditioner, which makes an even windrow, necessary for big baling. Rake 4 to 6 m of 280 mm growth into 1,2 m windrows.
- 1 big baler with a variable size bale chamber, or fixed chamber of 1,2 m.
- 1 spike adapter for buckrake or front end loader and rear bale carrier.

or

1 flat-bed 4-wheel trailer, 8 to 12 big bale capacity.

Workrate = 6,5 ha/10-hour day, ensiling 72 t of 30% DM silage or 150 bales stored.

Notes:

- An additive applicator using different size nozzles for acid and molasses should be fitted to the harvester or baler, rather than trying to spread by hand. Carbohydrate additives such as maize meal or dried molasses, however, do not need a special applicator and can be spread along the windrow.
- Flail or double chop forage harvesters should be correctly set to avoid soil and dung contamination of the silage. A level pasture is an advantage.
- Two-wheel trailers attached to the forage harvesters tend to damage the harvesters' wheel bearings.
- Direct chopping a young, high quality pasture could make a good silage if the pasture is first desiccated with a herbicide, but this method of ensiling is still under test.

Feeding the silage

Pasture silage that is made in bunkers is easily self-fed and, provided enough space is allowed per animal, there should be no restriction on intake. The width of silage face allowed per animal with 24 hour access is 110 mm, but 760 mm per animal where all animals must feed at the same time. In order to avoid mould development and secondary fermentation, at least a 200 mm depth of silage should be used daily.

If the bunker silo is filled to a height of 2,0 m or more, then there is a risk that the silage face will collapse when animals burrow into it; therefore a barrier is recommended which will prevent them from burrowing. The most satisfactory barrier is made from an electric fence strung across the face 1,0 m above the floor. The silage face of a self-feed bunker should be trimmed daily, and any old dried silage that is left on the floor of the silo should be removed to discourage animals from lying down and thus denying access to more timid animals.

Silage that is not being self-fed can be loaded, mechanically or by hand, onto forage wagons or trailers. A mechanical grab fitted to a front-end loader is often used, and in Europe, a hydraulically-operated guillotine fitted to a buckrake is common. The latter configuration is able to cut out a block of silage weighing up to 1 t. For hand unloading, a silage knife or sharpened spade can be used, but both must always be kept sharp.

It is wasteful and expensive to feed silage by spreading it in the field. If the silage has to be fed in the field, a circular, tombstone type feeder is ideal. Fenceline feeding is a cheaper alternative.

The intake of pasture silage by ruminants is reputed to be relatively poor. Evidence, however, suggests that the intake of pasture silage high in DM, and with a legume component, is no different from that of any other silage, but when wet silage is fed, there is a poor intake.

A high energy supplement will usually improve the intake of well-fermented pasture silage.

Young ruminants do not perform as well on silage as do older animals, and all animals require an adaptation period of up to two weeks before the stomach flora can cope with the acidity of silage.

SUMMARY

- Plan your silage operation.
- Sacrifice quantity for quality.
- Utilize pasture seasonal surpluses.
- Wilt to a 30% DM content.
- Only use additives where necessary.
- Finely chop the pasture for good compaction and ease of feeding out.
- Seal within 3 days (big bale silage within 12 hours).

  Supplement with energy for good animal production.