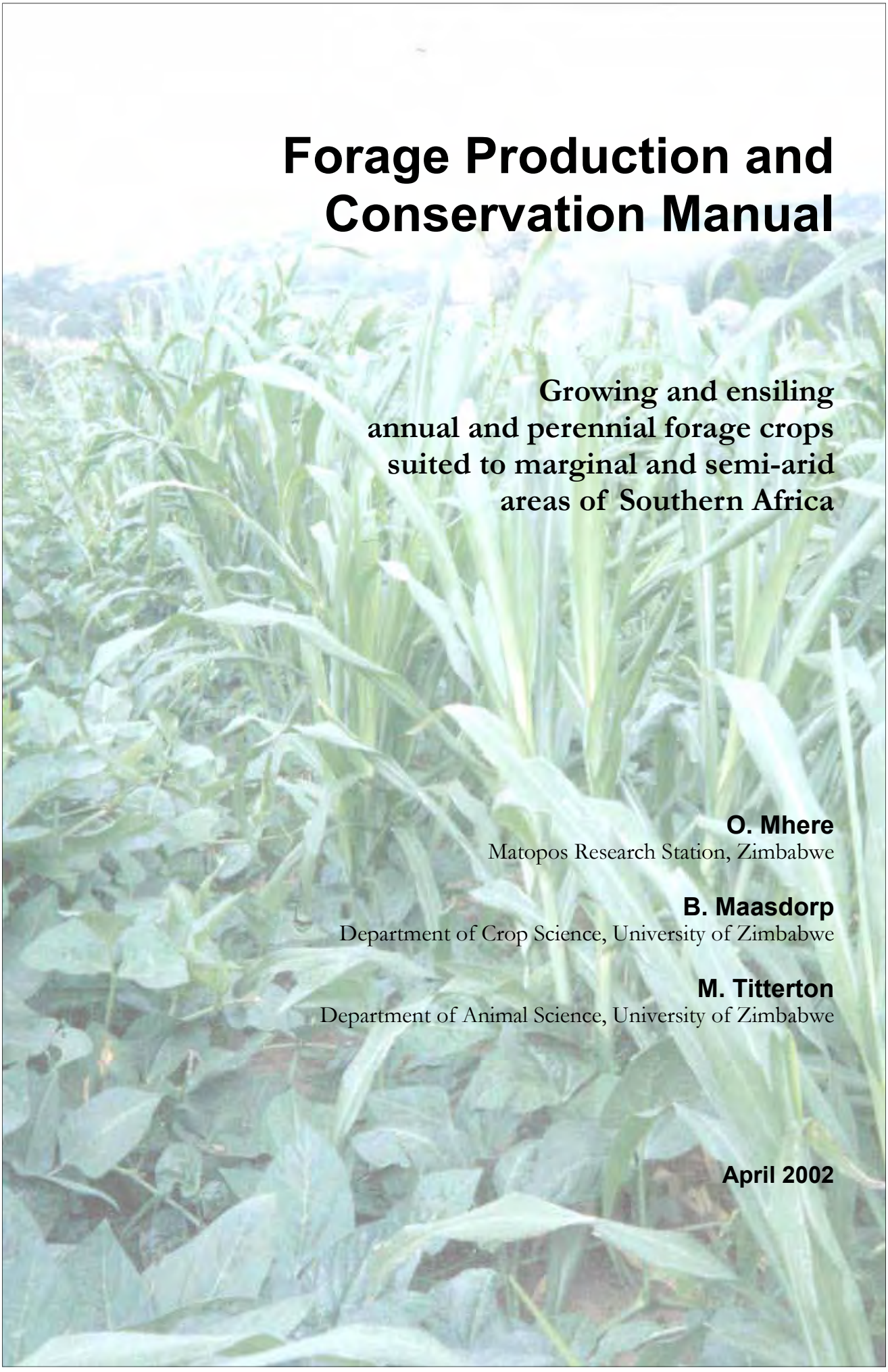

Forage Production and Conservation Manual

Growing and ensiling annual and perennial forage crops suited to marginal and semi-arid areas of Southern Africa

O. Mhere
Matopos Research Station, Zimbabwe

B. Maasdorp
Department of Crop Science, University of Zimbabwe

M. Titterton
Department of Animal Science, University of Zimbabwe

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The authors:

O Mhere
Matopos Research Station , Private Bag K5137, Bulawayo, Zimbabwe
owen@gatorzw.com

B Maasdorp
Department of Crop Science, University of Zimbabwe, PO Box MP 167, Harare, Zimbabwe
maasdorp@agric.uz.ac.zw

M Titterton
Department of Animal Science, University of Zimbabwe, PO Box MP 167, Harare, Zimbabwe
Current address
60 Rongopai Street, Palmerston North, New Zealand,
almar.foxton@xtra.co.nz

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Table of Contents

Introduction

The marginal and semi-arid areas of Southern Africa are not suited to crops without irrigation and irrigation is available to only a few farmers. Livestock production such as beef, dairy, goat and sheep are more suited to farming here for smallholder farmers who do not have access to irrigation. Dairying in particular is increasingly popular because it means cattle, which represent wealth, milk, draught power and manure can be used to bring in a cash income as well without having to sell them. However, because of the erratic and poor rains, and the long dry season, dairying is only viable if the cattle are supplemented with feed, otherwise the milking cows dry off early in the year and there is no milk to sell until they clave again. Also, with poor feeding, the cows often produce calves once every two or three years. A dairy cow needs to produce a calf every year so that she will produce milk every year. However, dairy farmers cannot afford to feed expensive commercial dairy concentrates as a supplement.

Here are the answers to common questions asked about how to overcome the problem of finding a feed which is good enough to ensure the dairy cow will produce milk for at least 250 days in a year and will produce a calf every year.

1 What are the major nutrients required to feed a dairy cow so that she will not only produce good yields of milk for 250 days but also have a calf every year?

The two major nutrients are energy (which comes from carbohydrate in the form of sugars, starches, cellulose and hemicellulose found in plants and their seeds) and protein, also found in plants and their seeds. The other nutrients are vitamins and minerals but they will be found naturally in most plants and if not, can be supplemented quite cheaply. Thus it is important that plants fed to cows are high in energy or protein or preferably both. Natural (veld) grass only has these for the cow for about three months of the year in the rains. After that they are not good enough for good milk yields and good fertility and furthermore, by September, there is often not enough grazing for the animals, especially in a dry year. Commercial dairy concentrates have energy derived from maize and maize by-products and protein from oil seeds which have been pressed for oil but all these are very expensive compared to energy and protein from forage crops produced on the farm. Feeding commercial stockfeed should only be done when farm gown forages are not able to meet the animals' requirements. If commercial stockfeeds are fed in place of farm gown forages, it is a sure way of losing a lot of money.

In summary, farmers need to produce forages for their animals to:

- Provide higher quality feed than the natural pasture can supply
- Increase overall carrying capacity of grazing systems
- Fill gaps in the feeds supply over the long dry season
- Provide a specialist crop for both feeding in the rains and for conserving
- Provide nutrients for the animals which are much cheaper than those found in commercial stockfeeds

2. What are forage crops?

Forage crops are plants which, when grown as a crop, have been found to produce high yields of plant material, which are also high in nutrients suitable for livestock requirements for maintenance and production. Natural pasture is a forage but is not grown as a crop, so is termed forage, not a forage crop. Forage crops produce much higher yields than natural forages and because they produce high yields, can be fed to cattle as both green forage during the rains and conserved for the long dry season.

3. What are the common forage crops used in Southern Africa?

i. Forages such as star grass, kikuyu grass and rye grass are popular for dairying, though are usually referred to as planted pastures rather than forage crops as they are perennial and grazed. They can produce sufficient plant material for both grazing and conserved forage, either as hay or as silage. They are generally produced under irrigation or at least in high rainfall areas, for good yields.

ii. Maize is usually thought of as a food crop, but certain varieties are suited to being forage crops because they produce very high yields of plant material when cut while still green and are very high in energy because of the maize seed which is in an early intermediate stage of maturity. Maize grows well in the high rainfall areas and is thus a popular forage crop for conserving and feeding dairy cows in the dry season. Since maize is high in energy but low in protein, maize can be intercropped with legumes such as velvet bean, dolichos bean or cowpea which are high in protein but do not ensile well on their own. In marginal areas, however, maize is not a good forage crop as it is very sensitive to moisture stress.

iii. In the marginal and semi-arid areas, forage sorghum and Pennisetum are more suitable forage crops because they are adapted to drier conditions. They are not as high in energy as maize but when intercropped with adapted legumes, such as dolichos bean and cowpea, produce a mixed forage that has enough energy and protein for good milk yields and good fertility in indigenous and crossbred cows.

Table 1. Nutrient content of forages

Forage	Energy (MJ/kg DM)	Crude Protein (g/kg DM)	Digestibility (%)
Forage sorghum/dolichos bean silage	9.5	116	67
Maize silage	11.3	77	71
Veld grass (cut in April)	7.5	35	55
Maize stover	6.5	48	30

4. What is the description of forage sorghum, Pennisetum, cowpea and dolichos bean?

i. Forage sorghum (*Sorghum vulgare)*

This is an annual or short-term perennial with culms (stems) of up to 4m height, with some types having sweet stems. Forage sorghums are grown specifically for livestock feeding. They are usually thin stemmed, tall, tillering profusely, leafy and produce less seed than the well known grain types, which are thick stemmed, short and produce a lot of seed, either red for brewing for white or food. Forage sorghum varieties available on then market include Sugardrip, Sugargraze, PAN 841 and PAN 888.

Fig 1 A stand of forage sorghum at Matopos Research Station in Bulawayo

ii. Napier grass and hybrid *(Pennisetum)*

Napier or elephant grass (Pennisetum purpureum) is a tall, tufted, robust perennial grass which originated in tropical Africa. The parents of hybrid Pennisetum are Napier grass and pearl millet (inyauthi [Ndebele] or mhunga [Shona]) (*Pennisetum glaucum*). Hybrid Pennisetum resembles Napier grass in appearance, although there are variations between varieties. In Zimbabwe hybrid Pennisetum is frequently referred to as bana grass, though in Kenya 'Bana' is a particular cultivar of Napier grass. Napier fodder produces little viable seed and the hybrid is sterile (does not produce seed), so establishment is done vegetatively.

Fig 2 A stand of hybrid Pennisetum (Bana grass) in Gulathi communal area of Matobo district (variety – PN-1)

iii. Cowpea (Vigna unguiculata)

This is a herbaceous annual leguminous crop with trailing or twining stems varying in growth habit from bushy to spreading. It is commonly called nyemba (Shona) or indumba (Ndebele). Several forms of cowpea exist for different purposes. The early maturing types are mainly used for grain, while the late maturing more spreading types are used as vegetables (fresh or dried leaves) or as forage for livestock (as green chop, dried hay and haulms or as silage). Pods are 10-23 cm long with 10-23 seeds in each pod. Seeds are very variable in colour.

Fig 3 A stand of cowpea at Henderson Research Station in Mazowe.

iv. Dolichos bean (*Lablab purpureus*)

This is a summer growing, vigorous herbaceous annual or short-lived perennial legume. It is also known as lablab bean, fiwi bean, dolichos lablab or simply lablab. Flowers range from white to blue to purple. Pods are 4-5 cm long containing 2-4 seeds. Seed colour range from pale blown, red to black and varies

with variety. The legume is used mainly as animal feed although it is used as relish in some parts of Africa.

Fig 4 A stand of lablab (dolichos bean) at Henderson Research Station in Mazowe

5. Why should forages be conserved in the dry season?

For dairying to be successful, there must be year round feed supply. If veld grazing only produces sufficient forage for three months of the year, it is important to produce and conserve forages in sufficient quantity and of good enough quality. Conserved forage is needed to maintain milk production over the dry months as well as put the cow into good condition so that she will conceive within four months after she calved and thus have a calf every year.

6. How should forages be conserved for the dry season: hay or silage?

Forages can be conserved as hay or as silage. Natural pasture (veld) and planted pastures can be made into hay, provided they are cut early enough – by March – to conserve the nutrients, especially protein, before they decline in the plant. However even in March, it is often too wet to dry the pasture successfully and special machinery, which is very expensive, has to be used to assist the forage to dry quickly.

Other forage crops such as maize, forage sorghum pennisetums are too thick-stemmed to dry successfully as hay.

It is difficult to make hay successfully from legumes as they drop their leaves very readily, either when handing the dried material or if allowed to get too mature before cutting.

Silage is considered the better way to conserve forage crops. A forage crop can be cut early and only has to have 30% dry matter to be ensiled successfully. There is no need to try and dry out the plant material any more than that, so wet weather is not such a

constraint as it is with making hay. This means the crop can be cut in March, depending on when it was planted, as if legumes are intercropped with the forage, they will not lose their leaves at cutting.

7. What is silage?

Silage is the product from a series of processes by which cut forage of high moisture content is fermented to produce a stable feed which resists further breakdown in anaerobic storage. The objective is to retain or augment the nutrients present in the original forage and deliver a silage accepted by livestock; this is usually attained through an anaerobic fermentation dominated by lactic acid bacterial. A good silage make from tropical forages has a pH less than 5.0, the percent of total nitrogen which is ammonia (NH_3N:N) of less than 15%, lactic acid which is 50% or more of the total organic acids and butyric acid content of not greater than 0.5% of the total dry matter.

When forage is put into a sealed container such as a pit covered with plastic, a drum or a plastic bag, the container is called a silo. A silo has to be completely sealed against air and the forage material must be chopped and compressed in the silo to ensure the fast development of anaerobic conditions and a rapid fall in pH. In these conditions, lactic acid bacteria, which convert some of the sugars in the plant into the pleasant tasting lactic acid, prevail over undesirable bacterial such as Clostridia which produce butyric acid, which is unpalatable to livestock, and moulds, which cause rotting of the silage. A good silage has a sweet smell and cattle, goats and sheep will readily eat it. Silage can be made quite cheaply and easily, provided it is done correctly.

Growing the crops

1. Seed supply / planting material

Sorghum:	Seed Co., Pannar, National Tested Seeds, Impala Seeds and Farm and City
Dolichos bean:	National Tested Seeds, Farm and City, Government Agricultural Research Stations and the Dairy Development Programme (DDP)
Cowpea:	Communal areas for trailing types, Pannar Seeds, Impala Seeds and agricultural produce markets in Bulawayo and in Harare; Pannar Seeds, National Tested Seeds, produce market in Mbare
Pennisetums:	Matopos Research Station (Bulawayo), Grasslands Research Station (Marondera), Henderson Research Station (Mazowe) and Makoholi Research Station (Masvingo) and established DDP smallholder dairy projects across the country

2. Where to plant

All the four crops are adapted to quite a range of soils. Good drainage is necessary for good growth. Hybrid Pennisetum and sorghum do best in deep fertile soils be they sandy or clay. Dolichos bean and cowpea tolerate soil texture variations from sands to heavy clays.

3. Land preparation

Full seedbed preparation is required ie ploughing and disc harrowing.

4. When to plant

Sorghum, Pennisetums, cowpea and dolichos bean should be planted when effective rains are received (usual time of starting to plant maize and grain sorghum). Planting is done annually for all expect Pennisetums, which are perennial and only replanted when gaps are noticed in the plots.

5. How to plant

Sorghum, cowpea and dolichos bean are all planted from seed, whilst Pennisetums are planted from rooted tillers or stem cuttings. All are usually planted by hand although tractor operated planters can be used.

Seed of sorghum and the legumes is planted into rows marked at a particular spacing depending on the system used, which could either be as sole crops or as intercrop. If planted mechanically (drilled), the seed should be placed at a depth of 2-5cm. If planted by hand, shallower planting into moist soil is superior as opening up a deeper furrow causes more drying out of the soil.

Pennisetums are planted in furrows or holes dug along row. If rooted tillers are used, all roots plus one node should be in the hole and one node above ground., whereas two nodes must be buried and one aboveground if stem cuttings are used. Rooted tillers or stem cutting should be placed into the dug holes at an angle of 45°.

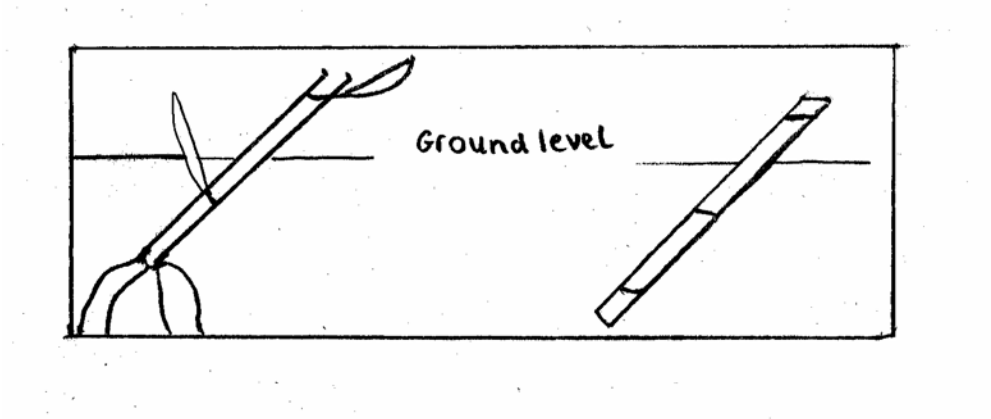


Illustration 1 Planting the rooted tiller or stem cutting of Pennisetum

After placement of the rooted tiller or stem cutting always refill the hole with soil and press with your feet around the plant to ensure good plant soil contact and to prevent ingress to the roots, which could dry them and kill the plant or slow the establishment process.

The intercrops are planted with one or preferably two rows of legume between cereal rows. These arrangements are illustrated below. The * * * represents the grass crop, either sorghum or Pennisetum, whilst ● ● ● represents the legume, either cowpea or dolichos bean, placed in between the sorghum or Pennisetum.

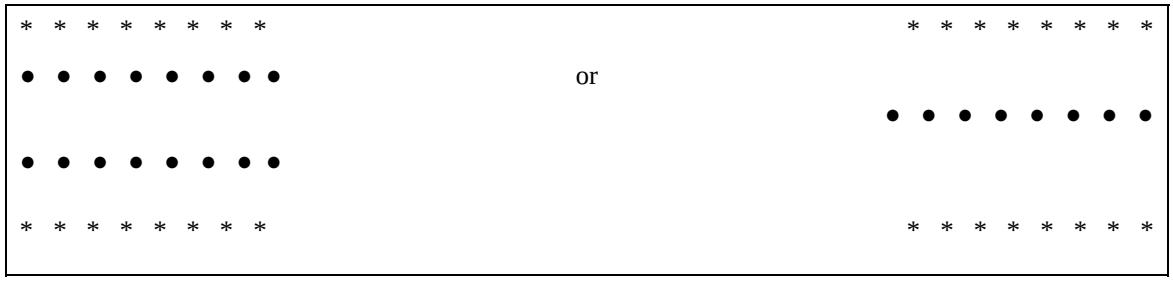


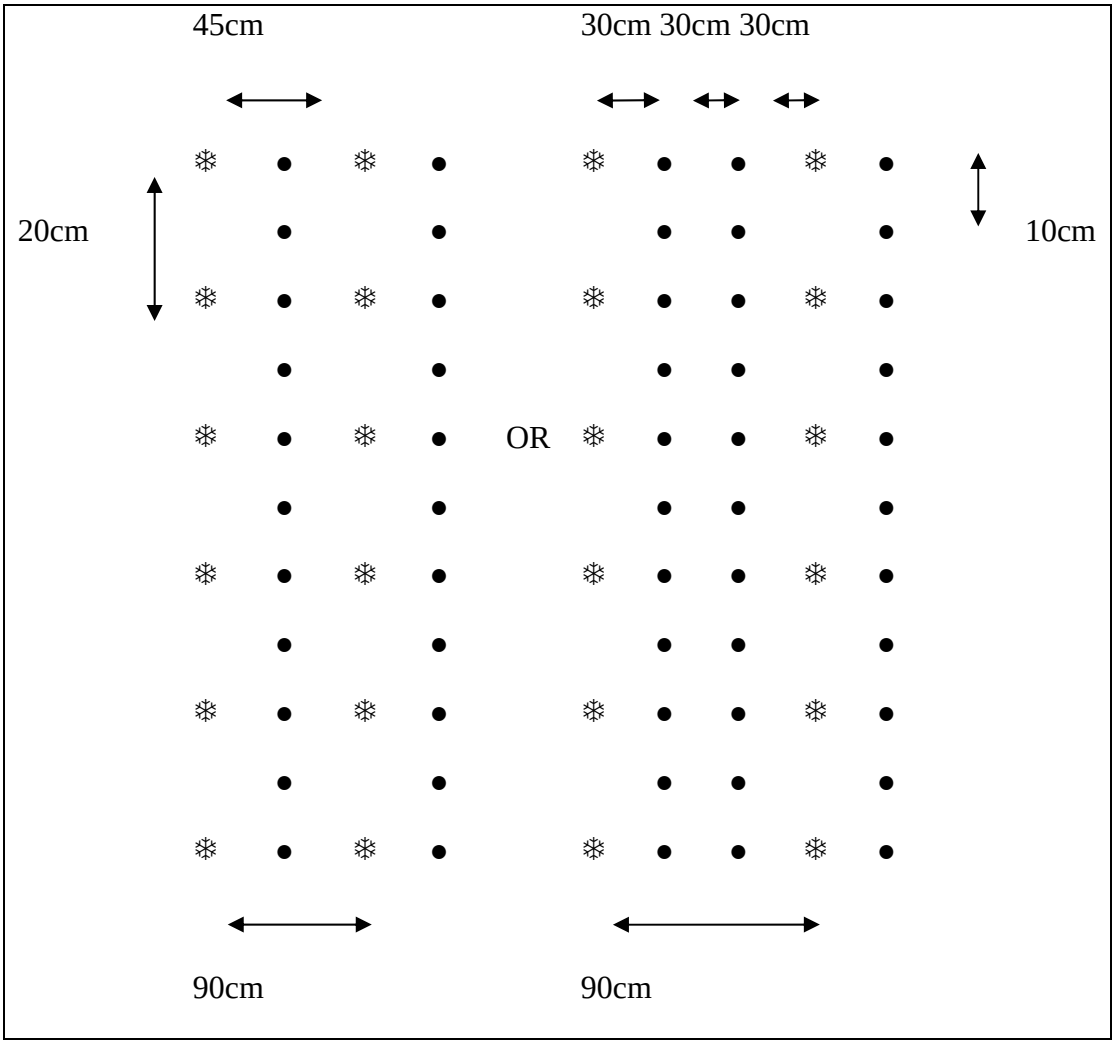
Illustration 2. Arrangement of cereal (*) and legume (●) rows for intercropping

Fig 5 A young crop of Pennisetum and cowpea in Gulathi communal area of Matobo district

Fig 6 A young crop of Pennisetum and dolichos bean

6. Spacing

The spacing used between rows and within rows is determined by the grass species and planting arrangements used. It is recommended to plant sorghum rows at a spacing of 90cm (3 feet) or in some situations at 75cm (2.5 feet) (as for grain sorghum). The cowpea or dolichos bean is planted either midway between two sorghum rows, or with 30cm between legume and sorghum rows (with sorghum row spacing of 90cm) if two rows of legume are being planted between sorghum rows within the row leave 20cm (8 inches) between plants for sorghum and 10cm (4 inches) between plants for the legumes.

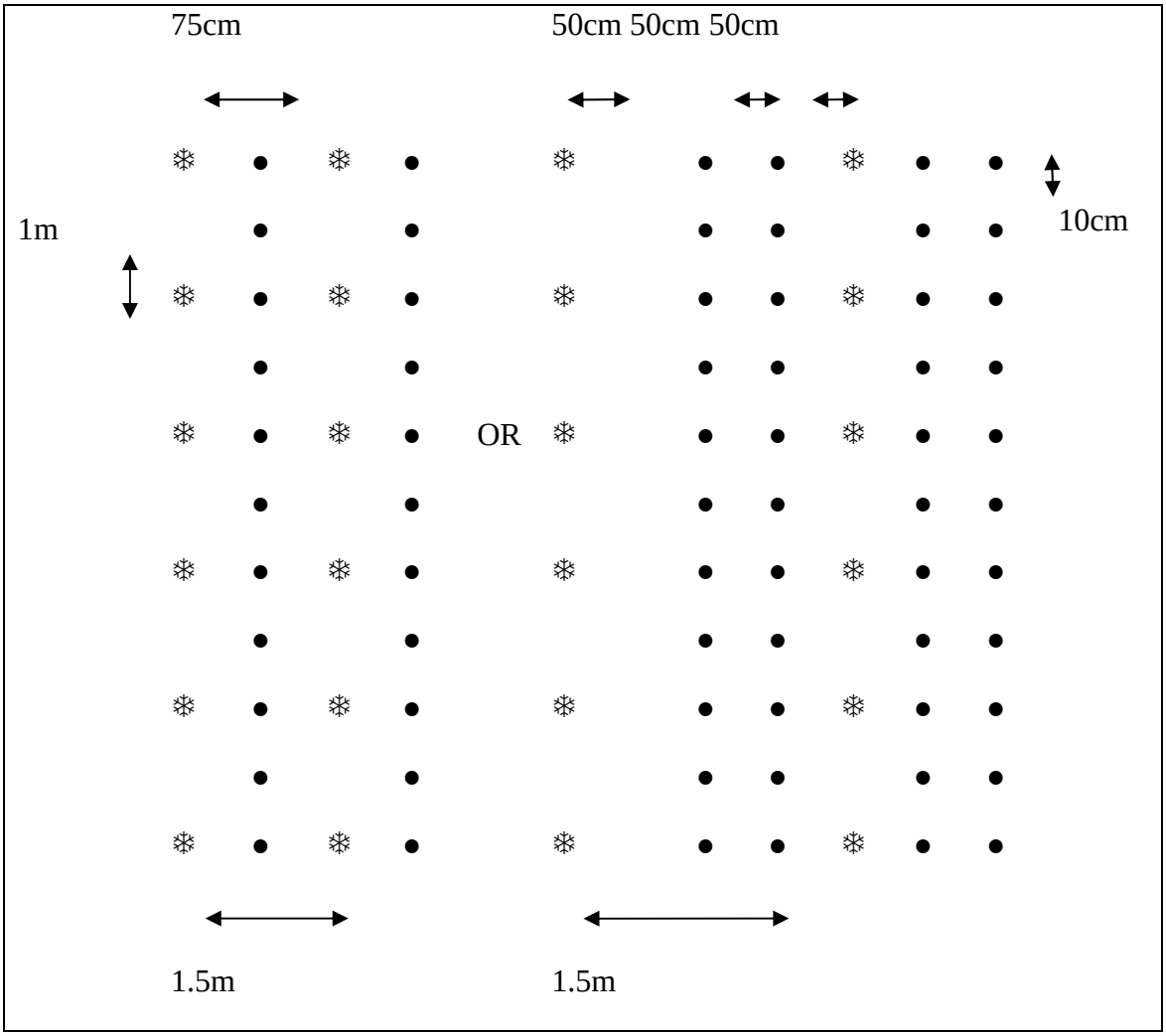


❄ Grass crop - sorghum

● cowpea or dolichos bean

Illustration 3 Spacing for intercropping of sorghum and legume

Pennisetum rows should be 1.5m (5 feet) apart. Within the row allow 1m (3 feet 3 inches) between Pennisetum plants and 10cm (4 inches) between legume plants. The intercropped legumes are planted either midway between the Pennisetum rows or with 50cm between legume and Pennisetum rows.



❄ Grass crop - sorghum

● cowpea or dolichos bean

Illustration 4 Spacing arrangements for intercropping Pennisetum and legume

7. Fertilizer / Manuring

The fist thing to do before once considers use of fertilizer is to attempt to send a soil sample for testing. Farmers should be encouraged to consult an AGRIETX officer, DDP project officer, or any officer from a Government Research Station or NGO project officer. General guidelines are discussed below. These may be modified on the basis of soil test results.

All these crops will respond to fertilizer application, as any other crops do. Since cereals and legumes are being discussed, the two groups will be considered separately as they have somewhat different soil nutrient requirements

i. Sorghum and Pennisetum

These need to be fertilized at planting as for maize of grain sorghum. This can be done using either manure or fertilizer. If fertilizer is used then Compound D at 300kg/ha, ie 6 x 50kg bags (120kg/ha) can be banded on one side of the marked sorghum rows or dug holes/furrows for the Pennisetum. Where no fertilizer is available, well-decomposed cattle or goat manure can be used at 4,000kg/ha (1,600kg/acre).

Topdressing of the sorghum with ammonium nitrate (AN) will be done as for maize, ie 100-150 kg/ha at about 6 weeks after planting. For the Pennisetum, topdressing is done when the grass is well established and after every cut. This is usually done using 100-150kg/ha/cut (2-3 bags) of AN in low rainfall areas and 200kg/ha/cut in higher rainfall areas. The reason for top dressing hybrid Pennisetum after every cut is that harvesting removes nitrogen from the soil (as well as other nutrients) which needs to be replaced to support more leaf growth.

Pennisetum needs an annual dressing of fertilizer, which should be applied after the first effective rains. The same fertilizer or manure as applied at planting is used. In addition, there is need to apply potassium chloride, commonly know as muriate of potash, at 60-100kg/ha, to replace potassium removed in the cut forage. AN topdressing is then applied after every harvest as in the establishment year.

ii. Cowpea and dolichos bean

These are legumes which ‘manufacture their own nitrogen fertilizer’ just like groundnuts, bambara nuts and soyabean, through their association with rhizobia bacteria in nodules on their roots. Cowpea and dolichos bean generally grow well without fertilizer in reasonable fertile soils. However, in soils of low fertility there is need to apply about 250kg/ha single superphosphate (SSP), banded in the legume rows just before planting.

Cowpea nodulates freely with rhizobia that occur naturally in the soil. Dolichos bean does not nodulate so readily with naturally occurring bacteria so it is advisable to inoculate the seed with rhizobia. Rhizobia innoculants can be obtained from the inoculant factory at Grasslands Research Station, Marondera, either directly or ordered through agri-dealers such as Farm and City. It inoculants are not available one can still plant dolichos bean, though it might be less efficient at fixing nitrogen.

8. Weed control

Weed control must be done in the same way as it is done for other crop. With these intercrops there will be no need to weed any more than twice as the crops will quickly cover the ground area and smother weeds.

Fig 7 Cultivating

Fig 8 Hand weeding

Fig 9 A weed-free strand of intercropped Pennisetum and Lablab

Fig 10 A growing crop of forage sorghum and Lablab

Fig 11 A growing crop of Pennisetum and cowpea

Fig 12 A growing crop of Pennisetum and Lablab

9. Pest control

The shoot fly is a major pest of sorghum seedlings. The larvae feed on the shoot apices when the seedlings are about 30cm, causing wilting and later the characteristic ‘dead heart’. When conditions are favourable for crop growth, the young plants may compensate by tillering. Prevention may be achieved by broadcasting disulfoton at the time of planting or after seedling emergence, or by spraying the young crop with trichlorfon or endosulfan at 7-10 days intervals. However, spraying after signs of infestation are noticed may not be fully effective, because considerable damage would have already occurred.

Stalk borers can also be a problem in sorghum. The most abundant and important stem borers species at low altitudes is the spotted stalk borer. Damage is caused by the larvae (caterpillars), which initially feed on young leaves but later tunnel into the stems. The growing points may be killed, resulting in ‘dead heart’ and consequent cessation of plant growth. In areas with a previous history of infestation, preventative insecticide application may be the best option. A spray of endosulfan or granules of trichlorfon applied to the funnels may be used 305 weeks after emergence, or alternatively, at the first sign of crop damage.

The pink stem borer can also attack sorghum. It attacks plants less than 15cm high and external borer holes may be found near the base of the stem. Damage leads to the central leaves withering and turning brown, with stunted growth and poorly developed ears. Chemical control is difficult to achieve as the young caterpillars bore into the stem immediately after hatching and are thus protected from contact with insecticides. Preventative sprays of endosulfan or carbaryl may be applied to the young crop if there is a history of pink stem borer damage.

Pests to not normally attack pennisetum.

For cowpea and dolichos bean, aphids, leaf cutting and pod bring pests are the most common. The sap-sucking aphids can cause wilting and leaf drop and the incidence of sooty mould. As a cultural control measure, it is advisable to destroy weed hosts and volunteer crop plants in advance of planting. In situations where the populations of the pest are high, it may be necessary to apply an insecticide. Dimethoate will control aphids, as will endosulfan, monocrotophos or demeton-S-methyl, whilst leaf cutting and pod-boring pest can be controlled by carbaryl. The local AGRITEX officer should be consulted for advice on mixing and spraying pesticides.

Harvesting the Forage

Harvesting of these forage crops needs to be done at particular growth stages so as to optimise both quantity and quality of biomass. Sweet stem sorghum should be cut at milk dough stage, together with the intercropped legumes. The sorghum grains are at the milk dough stage when you squeeze/crush the grain and milk oozes out of the grain. As a very broad guideline, if planting was in late November to mid-December and there has been a normal rainfall distribution, once can expect to be harvesting by mid to late March, ie about 14 weeks after planting (WAP).

Fig 13 Forage sorghum and lablab close to harvesting

Fig 14 Forage sorghum and cowpea close to harvesting

In addition to seed maturity, a way of checking that the sweet stem sorghum crop is ready for harvesting is to test that it has a dry matter (DM) content of around 25-30% (moisture content of about 70-75%). On a dry day in the late morning, chop up finely sorghum plant and a legume plant and mix them, then squeeze a handful of the mixed plant material in your hand. Open your hand and watch the plant material. If it opens up slowly, it has a DM content of about 30% and is ready for harvesting now or within a day or two. If it does not open but remains a pulp in your hand it is not dry enough and

needs another week before harvesting. If it springs open and falls apart rapidly, it may be too dry already and must be harvested as soon as possible.

Other forage sorghums can be harvested at about one metre height together with the legumes. This can be repeated if there is sufficient regrowth. Again, it is best to check for dry matter content before harvesting.

In the first year Pennisetum should be harvested only when the plants start to exceed one metre high. From year 2 onwards it is important to harvest the Pennisetum early in the season, soon after planting the intercropped legume, usually around late December to mid-January. This reduces competition with the legume. It will then regrow and should not be allowed to grow beyond one metre before cutting because it becomes very stemmy and the quality of the forage declines. It is then cut together with the legume. Use the dry matter test before ensiling the same way as with the forage sorghum (wilt the forage if too wet – see later section). The early cut of Pennisetum can be fed directly to the animals or, if extra silage is required, it can be ensiled.

It is best to cut the forage when the weather is clear (to avoid excessively wet forage) and in the mid-morning when plant sugars are at their highest.

All forages should be cut about 20 centimetres (about 9 inches) above the ground so that soil does not get into the silage. Soil is bad for silage because it prevents proper fermentation and makes the silage more unpalatable.

Fig 15 A strand of Pennisetum and Lablab ready for harvesting

Fig 16 Pennisetum should be harvested at a metre high for good digestibility

Fig 17 A strand of Pennisetum which is too high and will be less digestible

Fig 18 A harvested crop of Pennisetum leaving about 20cm stubble

The Ensiling Process / Making Silage

1. The use of wilting and inoculants to ensure successful ensilage

The first cut of Pennisetum will be very wet as it is young plant material. The chopped material can be left to wilt in the sun for five hours before ensiling. If it can only be cut in the afternoon, it can be left overnight, then ensiled by mid-morning the next morning. It is best to use an inoculant to assist it with fermentation.

The second cut of Pennisetum may still be very wet, depending on the rains, when it is ready for harvesting. A dry matter test is necessary and if the plant material is too wet, it should be cut and wilted in the same way as the early cut. If possible, clear weather should be chosen for harvesting, especially with Pennisetum. Any plant material should not be left any longer than a few hours in the sun or overnight for wilting because it will start to go mouldy and lose its nutrients, so it would not be good to have rain on the plant material once it is cut as this means it has to be left to wilt for even longer.

Fig 19 A harvested crop being taken for chopping and ensiling

It is recommended that an inoculant be used when ensiling Pennisetum and legume to assist with fermentation, as plant sugars are quite low compared with sorghum and may not be enough for correct fermentation to take place. This inoculant can be:

- Maize meal, applied at a rate of 5kg per 100kg forage material(50kg per tonne);
- Commercial inoculant such as Sil-All, which is available from SAFCO Animal Feeds, applied at a rate of 20ml Sil-All solution per 10kg forage (2 litres per tonne);
- Chopped sweet sorghum, applied at a rate of 10kg per 100kg forage material (100kg per tonne);
- Molasses at same rate as maize meal.

Since one hectare of forage on a sandy soil can produce up to 12 tonnes of fresh material, it is best to plan for the amount of inoculant to prepare accordingly. For example, if a small scale farmer has 0.5 hectares under sorghum or Pennisetum intercropped with legume, up to 6 tonnes of fresh forage may need inoculating, hence either 300kg maize meal, or 12 litres of Sil-All or 600kg of chopped sweet sorghum can be used. This should be applied by sprinkling over the cropped forage as it emerges from the chopper.

2. Chopping and compaction in the silo

- The purpose of chopping and compacting forage for silage is:
- To release as much plant sugar as possible for fermentation

To ensure that all the air is pushed out of the plant material so that when the silo is sealed, the plant material is free of air. This is when fermentation works best to produce lactic acid.

For large silos, such as large pits or bunkers (silos made from concrete walls above the ground), it is essential that the forage is chopped to 15mm length (about the length of the top half of your thumb). This usually requires machinery such as tractors and forage harvesters for forage crops on more than 2 hectares. The harvesting, chopping and compaction has to be done very quickly, no more than 3 days for forage per hectare and the silo sealed, before the forage can be spoiled. Tractors have to be used for compaction because of the quantity of the plant material.

For small silos, especially those that can be properly sealed, which are suitable for smallscale farms, the length of the chop can be longer, about 25-35mm in length (about the length of your thumb). Chopping can be done by hand but this can take too much time for forage on more than 0.1 hectares, so it is preferable that a small forage chopper be used such as those leased out by DDP or Matopos Research Station. The forage chopper is a chopper mounted on a frame on wheels, so that it can be transported from one farm to the next. The cut forage is fed into the chopper by hand.

It is important to try and time the cutting of the forage to match the time the chopper is available so that the cut forage is not sitting for more than a day waiting to be chopped and ensiled, otherwise it will become mouldy

Fig 20 hand chopping forage with pangas on logs

Fig 21 Feeding a hand-driven chopper with forage

Fig 22 A forage chopper – driven by a diesel engine

It is important that once the forage has been chopped it is placed in the silos and compacted as much as possible to get the air out before the silo is sealed. If bags are used, leaning heavily on the forage material in the bag then tying the remaining plastic

as close to the material as possible and as tightly as possible, will compact the silage and then seal it from air. Make sure there is enough plastic to tie, up, so that it does not come free from the twine. Tobacco twine or hay baling twine is best for tying up the bag and it should be twined around the top of the bag several times to ensure the bag is completely sealed.

Fig 23 Filling and compressing chopped forage in bags

Fig 24 A filled, compressed bag tied tightly at the top with twine to seal the silage

If a pit is used, the forage can be compacted using water drums pulled by oxen, then sealed with a sheet of unbroken plastic well tucked into the sides. On top of the sheet, a thin layer of sill can be put and old tyres or smooth stones placed over the soil to add weight. If possible, the silage should form a 'crown' in the pit, so that any water from rain or dew will run off into the surrounds instead of into the pit.

3. The small scale silo

There are two types of silos commonly found in smallholder farms in Southern Africa.

i. The plastic bag

Research has shown that recycled plastic bags or reject fertilizer bags, both available from manufacturers or fertilizer companies, make very good silos. One bag can hold 15kg of silage, which is enough feed for a cow in the dry season for one day. The fertilizer bag is the best type to use as it will last for at last three seasons. There are many advantages to having this type of silo which are:

- The silage is completely sealed in the bag. This means that all the acid is retained in the silage, unlike that in pit silage when it seeps out through the bottom of the pit as effluent. This compensates for the longer pieces of forage and poorer compaction than that found with silage machinery, so that the quality of the silage is just as good.
- Ensiling in a bag avoids the hard work of having to remove silage, as it has to be from a pit, when it has to be dug out every day.
- Because the whole bag is fed out to the animal, it means the rest of the silage which is in the other bags is not exposed to air at removal and is therefore unspoiled. Much of the silage in pit s has been found to be spoiled due to poor sealing and exposure to air every day when the silage is removed for feeding.
- The bag is easily stored and easily portable so that any member of the family can carry it to the feed trough for the cow.

Fig 25 A reject fertiliser bag holding 15kg silage: easy to carry

Fig 26 A number of bags, ready to be taken to the storeroom

Fig 27 Bags being carried to the storeroom at the milking shed

It is important to store the bags of silage in a room near the milking parlour or feed troughs, which is completely sealed from rodents and ants, as these can do a lot of damage to bags. Every year before ensilage begins, the room should be checked and even the tiniest holes sealed up.

Fig 28 A milking shed with storeroom- making it easy for a woman to take the bag to the feed bunk in the milking parlour

Fig 29 Plastering and sealing a storeroom to ensure it is rodent proof

The silage will be ready to feed after three weeks. After emptying, the bags must be carefully washed, dried and stored in a safe place for use the following year.

Sources of plastic bags: Saltrama – Harare

Tregers – Harare and Bulawayo

ZFC – reject fertiliser bags

ii. The pit

The pit is cheaper to use than plastic bags, as it is simply a hole dug in the ground but it does have its disadvantages as explained above. The chop length of the forage should be no more than 2cm and compaction as thorough as possible with the use of heavy water drums pulled over each layer. However, if bags are unavailable or the area under forage crops is greater than 2 hectares, the pit is the better silo because of the mass of the forage material. The pit should be dug

where the water table is not near the surface, eg on an upward slope. The side walls of the pit should slope slightly inwards towards the bottom, so that settling of the silage will not produce pockets of air at the sides, which can cause spoilage. The sides must be completely smooth, with no rocky outcrops or bumps for the same reason. Trenches should be dug either side of a pit to facilitate surface run-off water being diverted away from the put, the pit should e about 2 metres in depth (no more than that) and assuming 0.5 hectares was put under silage, and 6 tons of silage was produced, 1.5 metres wide and 3 metres long, with one end sloping to allow easy entry and exit of the water drums. If one hectare is grown, then the put can be deepened to 3 metres and the length to 5 metres.

The pit must be filled as quickly as possible (no less than three days for one hectare) and sealed with plastic sheeting, which must be well tucked in at the sides. A thin layer of soil can be spread over the sheet, when old types placed over that.

When the silage is ready to be opened, after 3 weeks, be sure to carefully scrape away the soil so that none of it gets into the silage.

At least 5cm should be removed from the face to ensure no spoilage bacteria get into the rest of the silage. If 15kg silage is to be fed to two cows, that is 30kc silage, two fertilizer bags would be enough.

After removal of the silage, the plastic sheeting should be pulled back over the silage to seal it as much as possible until the next day.

Feeding silage

Silage removed from a pit or emptied out from a bag should be fed as soon as possible, preferably within a few hours. After this it can be mouldy and become unpalatable because of toxins formed in the silage when it is exposed to air. After feeding, the feed bunks must be cleaned out to prevent any remaining silage, which will spoil, contaminating the next feed out.

It has been found that indigenous and cross bred cattle, when fed one bag of silage a day for at least two moths of the dry season (August and September), calve down in good condition in October and will conceive within five months of calving.

Fig 30 A cow in good condition after being fed one bag of silage a day in the dry season

Fig 31 Cross bred and indigenous cows all in good condition when supplemented with silage drying the dry season

If there are only 100 bags of silage and there are two cows to feed, it is best to feed them in the dry season for two months before calving. If, however, there are more bags, two cows can be fed for two months before calving and then, if there is no rain until November, fed until the rains come and there is plenty of good fresh grass. With more

bags, they can be fed as long as possible while they are in milk, so that they are producing right up to August before they dry off.

It is important to feed for at least two months before calving so that the cow is in good condition at calving and then to make sure she is either getting good fresh grass or silage in her early lactation, then any extra silage can be fed after that for as long as he is in milk. This is how silage can ensure the cow is giving good milk and is fertile at low cost, thus ensuring good profits for milk.

Fig 32 The reward for feeding silage to cows in the dry season – carrying milk to the depot