



FODDER PRODUCTION and CONCENTRATES

If you keep animals, fodder needs to be provided throughout the year. The main sources are pastures for grazing, and grass, legume and tree crops for cutting and carrying. While indigenous breeds will cope much better with dry spells and low quality feeds, all dairy cows and dairy goats have to be provided with good fodder and high quantities at all times. It is therefore essential to conserve and store some of the abundant growth of the rainy season for use in the dry season.

Fodder cultivation for cutting

Grasses are the basic diet of all ruminants. Their fodder quality depends mainly on the stage when they are harvested. They provide the best fodder when they are cut at an early stage of maturity, before flowering, when their protein and energy content is still high. Fertilizing also contributes to quality. Napier grass is the typical grass for cut-and-carrying, but also grasses like Naivasha star grass, Bermuda grass or Elephant (Guinea) are suitable.

Napier grass

When Napier is well managed and cut frequently, it is of good nutritional value to dairy animals. You will need one acre of Napier grass or 25,000 kg fresh grass per year to feed a high yielding dairy cow of 450 kg live weight. On two thirds of an acre, you can grow enough fodder to feed a grade cow which yields around half the amount of milk (2-3000 litres per year).



Tumbukiza planting (pitting)

This planting method gives the highest grass yields also during the dry season. Because Napier grass can stand in one field for 3 to 5 years, the effort for digging is well invested labour!

- Dig pits one to two feet deep, one to two feet wide and one to two feet long. The distance between pits can be one to two meters. The rows can be one to two meters apart.
- Spacing depends on soil fertility and on rain amount: in a dry climate, spaces have to be wider.
- Mix 1 debe of top soil with 1 to 2 debes of farm yard manure and refill the mixture into the pits.
- Leave about 15 cm of unfilled space at the top of each pit.
- Plant 5 - 10 cane cuttings or single root splits into each pit.

Napier grass should also be planted along the contours of hillsides to prevent soil erosion.

- When Napier grass starts to grow stems, its nutritional value decreases quickly to almost zero and stops to support milk production.

Fertilizing

Apply some farm yard manure preferably after every harvest:

- You can use fresh slurry (manure with a high percentage of urine or water).
- Manure should not be older than two or three months, because it loses nutrients quickly during storage.

Weeding

Hand weed after every cutting/harvesting if necessary to maintain high productivity. Just throw uprooted or slashed weeds into the pit.

Dry season management

Planting in pits conserves water. If you add one bucket of water per hole once or twice a week during the dry season, Napier grass will survive dry spells better and will keep on growing and providing fodder.

Feeding

- Supplement Napier grass with leguminous fodder, and with dairy concentrates during early lactation.
- Chop it to reduce wastes.

Interplanting

It is recommended to plant sweet potatoes or vigorous forage legumes like Desmodium or Leucaena between the Napier pits or rows to increase forage quality and to control weeds.

Harvesting

- Napier grass is ready for the first harvest 3 to 4 months after planting.
- Harvest every plant when it is about 3 feet high.
- Harvest the grass following a pattern: Begin at one end of the row and cut enough grass to feed your animals. The next time, cut the next grass along in the row. Carry on until you reach the end of the row, then start the next row.
- Leave a stem length of 15 cm (hand length) from the ground at harvesting to ensure re-growth.
- Preserve excess grass as silage or hay (refer to the TOF-leaflet No 12 "Dry season fodder" for more information).

Maize management

Take advantage of the fact that green maize leaves are an excellent fodder for dairy animals! They provide more protein and energy than Napier grass. After harvest, maize leaves are almost worthless for feeding, while leave stripping and topping may produce up to 700 kg of good quality feed per acre without affecting grain yield.

High density sowing and thinning

In fertile soils, maize may be planted at higher densities than usual. Sow 3 to 4 seeds per hole instead of 2. 1 to 2 plants can be removed when the maize is knee high to feed dairy animals or for silage. Further excess plants are cut at tussling.

Leaf stripping and topping of maize plants

- From the time when the maize cobs have produced silk, you may start to collect maize leaves for feeding. Go through the field and strip the lowest leaf of each plant. Repeat this once a week, but take care not to remove the leaf directly below a cob and the one above it.
- When the cobs have reached the soft dough stage, the maize plants may be topped above the top cob.

Legume fodder crops and green manure crops

- They enrich the diet of ruminants with protein and calcium needed for milk production and for growth.
- They often grow on during the dry season when good feeds become scarce. Feed them at 30% of the ration.
- They should be allowed to wilt before feeding, and must be mixed with non-leguminous fodder to prevent bloat.



Lucerne (*Medicago sativa*)

Lucerne is considered the 'King of Fodders' because it provides ruminant fodder of the highest quality. Intake of digestible nutrients by livestock is higher than for most other forages. Milk and meat production rise when lucerne is added to the fodder.

If managed well, the crop can last up to 4 years, yielding about 6 cuts per year. It can be sown as a pure stand or in mixtures with grasses. Lucerne is used for cutting, grazing and for conservation as hay, meal, or silage. It does not grow well in acidic soils, but agricultural lime may help to reduce acidity. Where Lucerne has never been grown before, a Rhizobia inoculant needs to be applied.



Lablab purpureus

Lablab is a vigorous climber which can be intercropped with maize, sorghum and millets. It should be sown about 28 days after the main crop to avoid cereal yield depression from competition. Lablab is drought tolerant. Dry matter yield is usually higher than for cowpeas, and it is also more resistant to root diseases. When fed together with maize stalks or other residues, lablab improves the dry-season diet of dairy animals.

Like lucerne, lablab can be used for grazing, cutting and conservation, and in addition, green pods can be harvested for human consumption.



Desmodium

Desmodium has a long growing season and grows well together with grasses, in a pure stand, as a cover crop together with grains, or under fruit trees, bananas or coffee. It requires fertile soils and is not very tolerant of drought and heavy grazing. Rhizobia inoculant needs to be added to the seeds in soils where desmodium has never been grown before.

Green manure and cover crops

Most of them can also be used as protein rich fodder, but may have to be fed with more restriction (not more than 20% of the ration). Examples are purple vetch, Mucuna, Clitoria, Crotalaria, or Canavalia (Jack bean).

Fodder trees

provide high quality low-cost fodder all year round. Because most of them are leguminous plants, their leaves are rich in protein and an ideal feed supplement grasses and crop residues. Often animals get used to them only slowly, but once they acquired a taste for them and accept them, tree forages have a highly beneficial effect on milk and meat production. Important: they should not be fed in higher proportions than 30% of the diet, as they contain substances which can interfere with animal health.



Leucaena

Leucaena foliage is known for its high value as ruminant feed. It can be grown as an intercrop in hedgerows. It is deep rooting and relatively drought tolerant. Once established, it is extremely tolerant of regular defoliation by cutting, grazing, and slashing. Excess growth should be cut and dried.

Sesbania

Sesbania is also very rich in protein and a very good fodder for all ruminants. However, it should not be grazed or cut back intensively.



Calliandra

It is estimated that 3 kg of fresh Calliandra has the same effect on milk production as 1 kg of dairy meal. It should be fed fresh and not wilted or dried. 500 plants, planted in a hedgerow, provide enough leaves to supplement the diet of one dairy cow. Calliandra is not as drought tolerant as Leucaena and is also not tolerant of grazing and slashing.

Other good fodder trees include Gliricidia, tree lucerne, and mulberry. They all provide fuel wood and stakes, and act as fences, windbreaks or shade trees. They control soil erosion and improve soil fertility. Grow them as hedges along field borders!

Fodder production on pasture land

Pastures have to be equally well managed in order to optimize fodder production where land is scarce. Grazing usually requires more land than fodder cultivation for cutting. Under good climatic conditions, you need between 1 and 1.5 acres of good pasture to provide enough grass for one good dairy cow. Beef breeds are less demanding: on one acre of good pastures, you can keep one cow and her calf (for goats see the TOF-leaflet No 13).

For pasture production and quality, the same principles as for cut-and-carry can be applied. Young grass has the highest nutritional value and produces more meat and milk than grass which has been left to grow for months. Excess growth during the rainy season should be conserved to provide fodder for the dry season.

Field grazing

- Fields are divided into paddocks of about the right size which you need to graze your cattle for one or two weeks (see Table 1 below).
- Cows are moved (rotated) from one paddock to the next in a predetermined order.
- Calf groups should be grazed ahead of mature cows as their resistance against cattle parasites is still weak.
- In strip grazing, dairy animals are confined to an area with just enough grazing for one day.
- Dairy cows should not be kept in a paddock for more than 1 week, and beef cattle for 2 weeks. This avoids overgrazing, pasture destruction, and parasite build-up.



Take care that sufficient time is given to a pasture to recover after grazing. Overgrazed and degraded pasture land which has lost its plant cover is almost impossible to re-cultivate!

Stocking rates for cattle:

On 1 acre of good pasture, you can graze for one week:

- 5 high yielding dairy cows
- or 5 cows, one bull and 3 to 6 young animals of an indigenous beef breed

Poor pastures will feed fewer animals.

Rotation intervals on paddocks:

The grass must be 15 to 20 cm high, or enough to feed your animals for one week. When this stage is reached depends on the season and on the type of pasture. The period necessary to re-grow the grass can be 3 - 6 or more weeks.

Rehabilitation of pastures

- Pasture land can be improved with seeds from improved grass varieties and with legumes for higher yield and higher nutritive value.
- Grasses can be transplanted or grown from seeds
- Legume seeds can be sown between grass lines. Trees can also be planted to provide fodder, fuel and timber
- If a pasture is still in an acceptable condition, distribute seeds or seedlings just in patches with poor grass cover. This is best done at the beginning of the rainy season. Make sure that new plants are strong enough before you graze the plot. It may be better to cut the area once instead of grazing.
- Renovate pasture land of poor quality by ploughing or disking and re-sow.

Table 1: Feed and area requirements of cattle on good pastures (rough values*)

Type of cattle	Pasture per day for one animal	Pasture per week for one animal	Number of animals you can feed for one week on one acre (50 m x 80 m)
Dairy cow pure breed (5-6000 l milk)	10 m x 12 m	0.2 acres	5 cows
Dairy cow crossbreed (2-3000 l milk)	10 m x 8 m	Around 0.15 acres	6 – 7 cows
Beef breed (350-400kg)	10 m x 5 - 6 m	0.1 or more acres	8 – 10 mature animals, or: 5 cows, 1 bull and 3-6 young animals

*** Note:** If pasture quality is poor, a larger area has to be given to the animals! Observe your animals: if they stop grazing and become restless and noisy, you should check whether there is still sufficient grass for grazing.

Cutting excess grass during the rainy season

Some time after the onset of the rainy season, growth on pastures will exceed the amount your animals can consume. This is the time to cut the grass for conservation as hay or silage. Hay needs about two or three days without rain to dry in the field. For silage, the cut grass is left in the field to wilt and dry for about one day before the silage is prepared. For more information on fodder conservation see the TOF-leaflet No 12 (Dry season fodder).

Concentrates

If you buy concentrates, you have to be careful because their quality is often uncertain. Making your own dairy concentrates requires a lot of knowledge, as energy rich and protein rich feeds have to be mixed in the right proportions depending on forage quality of the basal diet. Here are the basic rules and four examples of home-made dairy concentrate formulations (recipes by KARI Naivasha).

Basic rules for the choice and combination of concentrate feeds

- The poorer the quality of the basal diet (roughages), the more concentrates are necessary to provide the nutrients required for milk production. This is because energy and protein content of all plant leaves declines with age.
 - Roughage must always make the larger part of the dairy ration. It is therefore essential that crude protein and energy contents of the basal diet are known at least approximately. Only then the correct kind and amount of concentrates can be calculated.
- Table 2 shows desired protein and energy contents of concentrates for supplementation in dependence of fodder quality.
- The higher a cow's milk production, the higher in crude protein and energy concentration the ration has to be.
 - 10 litres of milk: around 10% crude protein in the ration.
 - 30 litres of milk: around 13% crude protein in the ration.
- Feeds containing either a large proportion of proteins or energy can be used to supplement missing nutrients in an unbalanced ration. In Table 3 you find energy and crude protein content classes of common feeds often used as concentrates in Kenya.
 - The proportion of concentrates should never be higher than 50% of total dry matter of the ration. When fresh forages (which contain a lot of water) are fed, they should always provide over 80% of the weight of the ration. If forages are fed dried, they must form at least 50% of the ration's weight.
 - Concentrates are usually low in minerals. Especially Ca and phosphorus are additionally required.
 - Never use rotten materials such as maize (maozo) or affected wheat as both contain toxic aflatoxins.

Table 2: Desired crude protein (CP) and energy content of concentrates in dependence on forage quality

Main forage fed to the cow	CP content of concentrate	Energy level of concentrate
Well fertilized grasses at an early stage of maturity and legumes (use Formulation 1)	12 - 14%	10 – 12 MJ/kg DM
Forage at advanced stage of maturity (use Form. 2 or 3)	15 - 18%	around 12 MJ/kg DM
Low quality forage, crop residues (use Formulation 4)	18 - 23%	> 12 MJ/kg DM

Formulation 1

Maize germ meal* 54 kg
Calliandra leaves 45 kg
Mineral salts 1 kg
Cost Kshs** 10.70 / kg

Formulation 2

Maize germ meal* 77 kg
Cotton seed cake 22 kg
Mineral salts 1 kg
Cost Kshs** 11.80 / kg

Formulation 3

Maize + Cob 72 kg
Cotton seed cake 27 kg
Mineral salts 1 kg
Cost Kshs** 12.00 / kg

Formulation 4

Maize + Cob 78 kg
Fishmeal 21 kg
Mineral salts 1 kg
Cost Kshs** 19.10 / kg

*Maize germ meal from the brewery (low in CP, high in energy). Oil cake has medium-high CP / medium energy!

**Estimated prices: maize germ meal at Kshs 10/kg, fish meal at Kshs 50/kg, Cotton seed cake KShs 15/kg, maize on cob Kshs 10/kg, minerals Kshs 80/kg, Calliandra leaves Kshs 10/kg

Table 3: Energy and crude protein (CP) content of common concentrate components in Kenya

	Very high CP (>40%)	High CP (28 - 40%)	Medium to high CP (18 – 28%)	Medium CP (12-18%)	Low CP (<12%)
High energy (>12 MJ/kg DM)	Fish meal Soybean meal Groundnut meal				Molasses All cereal grains Maize germ meal Maize & cob meal
Medium energy (10-12 MJ/kg DM)	Cotton seed cake	Sunflower meal	Dairy meal 24% Brewer's grains	Dairy meal 16% Wheat pollard	maize bran
Low energy (<10 MJ/kg DM)	Blood meal Meat & bone meal		Leaves of leguminous plants	Wheat bran	

Shaded areas: Very unbalanced feeds which are either high in protein and low in energy or the other way round.

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