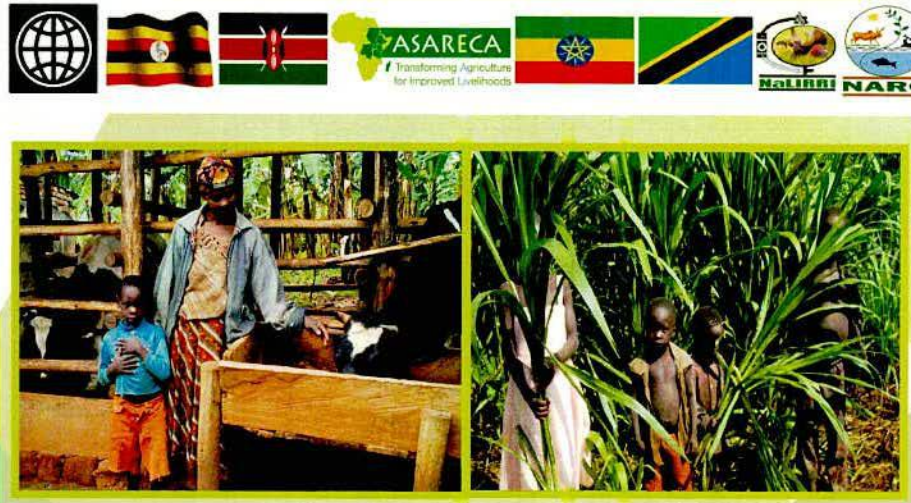
National Livestock Resources Research Institute (NaLIRRI)

Eastern Africa Agricultural Productivity Programme (EAAPP)



TIPS TO A PROFITABLE ZERO GRAZING DAIRY CATTLE ENTERPRISE

Introduction

Reducing malnutrition among children and pregnant mothers is a challenge to many development workers. One of the approaches is to improve production and increase availability of milk. With the ever-increasing human population, however, land holding per household is on the decline and, therefore, conventional dairy production is becoming more difficult. This is particularly so in peri-urban settings, where families need milk not only for domestic consumption, but also income generation. This scarcity of farmland calls for highly intensive dairy farming system to increase efficiency of land utilization, thus the **zero grazing system**.

Zero grazing is a system of dairy production whereby the dairy cows are kept in a stall all the time, and feed and water are brought to them. Animals are not taken to the pasture for grazing; pasture is cut from the field and brought to the stall for the animals to eat.

From the mid-1980s, development agencies in Uganda began introducing zero-grazing systems, in which high-yielding genetically

improved cows (pure or cross-bred with local cattle) are kept in stalls and fed with fodder cut and carried to them daily. These more 'intensive' dairy systems were promoted among Ugandan farmers along with training on managing dairy breeds and growing fodder. This gave many smallholders an incentive to buy exotic dairy cows or to upgrade their indigenous cows by cross-breeding them with exotic stock. Some of Uganda's small farmers adopted strict zero-grazing practices while others combined grazing paddocks with stall feeding, a hybrid dairy production system that came to be known as 'semi-intensive'.

Advantages of stall-feeding or zero grazing production systems

(a) Cows are confined and therefore use most of the energy from feeds for growth and milk production.

(b) Saves land for other enterprises by allowing the use of high yielding fodder crops like Napier grass.

(c) Enables on farm clean milk production.

(d) Good calf rearing is possible

(e) More manure which can easily be collected for the benefit of fodder and food.

(f) The animals are better protected against diseases, especially tick-borne diseases.

(g) Close observation of the animals is possible, making heat detection and attendance to animals easier and faster.

(h) The animals are kept inside which is more secure and protect them from attack by predators

(i) Employment opportunities for family members or other people as hired labour.

(j) A calf each year to either increase milking animals in the herd or for sale to increase household income.

Disadvantages of stall-feeding or zero grazing production systems

(a) Requires animals of higher genetic potential to make economic sense, which is more expensive.

(b) More land and labour devoted to production of forages and transporting the forage to the animals, preparing the forage and feeding in the stalls.

(c) Large amounts of forage and supplements required for high milk production.

(d) Increased expenses on disease control and treatment, because high milk producing animals are more susceptible to diseases such as milk fever.

(e) Much capital is required for construction of a "zero-grazing unit".

(f) There is a possibility that animals are stressed because of too much confinement inside the zero grazing unit.

(g) It might not be easy to detect cows with silent heat.

Zero-grazing stalls can be expensive to construct depending on the materials used; this reduces the farmer's profits. The farmer should therefore start with a simple shade using locally available materials like eucalyptus poles, papyrus and a polythene sheet. When the farm starts making profits then he/she can go in for a more improved (sophisticated) unit.

Tips to a profitable zero grazing enterprise

(a) The zero-grazing unit

Cows are kept and fed inside the stall all year. The site where the unit is built determines the efficiency of operations throughout the zero grazing enterprise. It should be near to the source of forage to reduce labor costs of carrying the cut grass to the cows and carrying manure back to the farm. Zero grazing requires an increased level of labour input, due to the need to cut grass daily. Proximity to the homestead in relation to the biogas plant is also an important consideration.

The quality and quantity of construction material should be assessed thoroughly to determine the least possible cost while maintaining quality of the house. Quality

materials which are locally available can greatly reduce costs. The cow shed must be functional, cheap and long lasting. The choice of an artisan is important because a lot of expensive material can be wasted by hiring a bad artisan. Note that the most expensively built stable is not always the best and most economical one.

Considerations during construction of a zero grazing unit

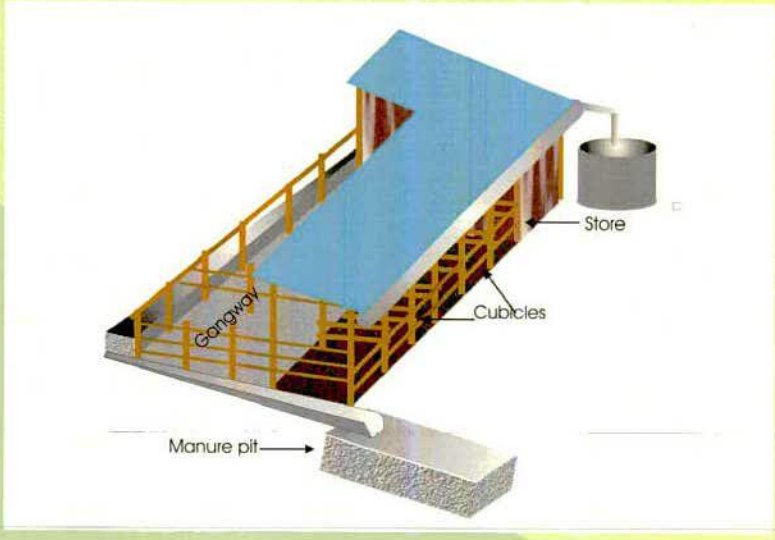
(i) Ensure that the correct site, considering the direction of wind, is chosen for the unit. The choice of site influences the security and protection of animals from rain, sunshine and other weather effects.

(ii) The location of the unit in relation to the house should ensure minimal smell from manure pit. It should be noted that it is more important to protect an animal from the rain than from wind or sunshine.

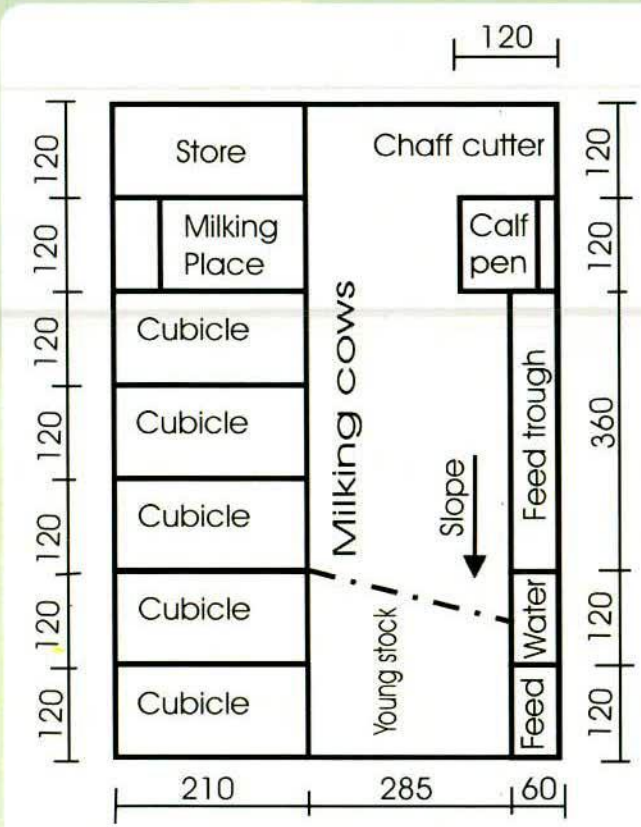
(iii) Ensure that the constructor is supervised by an experienced extension staff during the construction of the unit. This is necessary because some parts (i.e. walking area, troughs) once constructed are permanent. Mistakes made during construction can be costly.

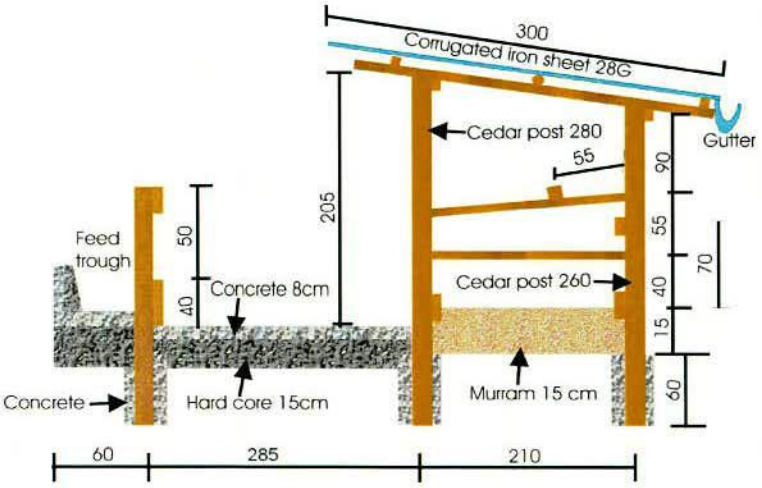
(iv) Use of local materials for construction of the unit would reduce cost.

(v) Finally, one should as much as possible, carry out regular maintenance of the zero-grazing unit while in use. This is important for the walking area.



Recommended zero grazing plan





Side elevation

The necessary parts of zero-grazing unit include:

1. The cubicle (resting and sleeping compartment)
2. The cattle walking
3. The cattle forage, feeding and watering place
4. The milking area

The cubicle (resting and sleeping area)

Each animal has its own compartment or sleeping place. Separation between compartments is done by wooden rails or posts. The floor of the house can be constructed from ordinary soil from the farm. Soil is much cheaper and comfortable to the animal than concrete or stones. The soil can be replaced if dirty or worn out. The floor of the sleeping place is raised 25cm above the level of walking and manuring passage. A soft bedding provides comfort to a cow and prevents wounds on its skin. In this way, the animal has a comfortable place which is cheap and easy to maintain. The recommended measurements for a cubicle are based on pure breed cows (Friesians and Ayrshires). The reason for this is because pure breeds give the highest economic returns in a zero-grazing system. They are therefore used



Cows in a cubicle

as the standard. A cubicle has a length of 210 cm (7ft) and a width of 120 cm (4 ft). Cubicles are separated from each other by two timbers.

If the cows are small in size (i.e. Jerseys), the measurements can also be smaller (6'6" x 3'7"). However, it is much better to use the above standard measurements for a cubicle because the size fits most animals. The standard cubicle can also be adjusted to fit smaller breeds whenever necessary. They can therefore be used for both larger and smaller breeds as need arise. The cubicle should not be too long or too wide or the floor will get dirty and consequently also the animals. The cubicle is of the right size if the droppings fall on the walking and manuring area and not on the floor of the resting and sleeping compartment. For heifers the length and width of the cow cubicle should be reduced by moving the neck control posts towards the manuring and walking passage and by fitting another side wall into the cubicle. Provide a roof over the resting and sleeping compartment in order to provide shade and to prevent the area from getting wet and dirty.

One should construct the number of cubicles enough to be occupied by animals most of the time. Unoccupied cubicles are a waste of space and money. For a given number of cows to a unit, extra cubicles are required to house young-stock (heifers). If young bulls are to be kept inside the unit (although this is not recommended), then they must be provided with separate cubicles. However, when the bull matures, it is better to house it away from the unit.

The recommended number of cubicles for a given number of cows (including followers – heifers or bulls) are indicated below:

Number of Cows:	Number of cubicles:
1 cow	2 cubicles
2 cows	3 cubicles
3 cows	5 cubbies
4 cows	6 cubicles
5 cows	7 cubicles
6 cows	9 cubicles

The resting area is roofed to provide shelter against rain and sunshine. A neck-pole is fixed across the cubicle. This prevents the cow from entering too far into the cubicle and ensures that the urine and dung will drop on the walking area. The cubicle and the cow then remains clean. Young animals should be separated from the milking cows. This will ensure no fighting occurs between young animals and cows. Cubicles for young animals should be adjusted according to their size by moving the neck-poles backwards to make the cubicles shorter. An extra timber can also be added lengthwise to make each cubicle narrower.

The cattle walking or manure places

The walking area is about 3 meters wide i.e. between the resting area and there the feed and water troughs are located. No roofing is required for this area except under very hot conditions. The floor of the working area is made of concrete (mix cement, sand and ballast in the ration of 1:2:3). This makes it possible to collect urine and manure. The floor and the cows are also kept clean. The surface of the floor should be rough so that animals cannot slip on it. But it should be easy to clean. The floor should slope from the milking place towards urine and dung collecting pit located at one end of the walking area. The slope should allow for easy cleaning of the milking and walking area.



Walking area of the unit

The feeding and watering place

The feed troughs should run along the length of the walking area with a water trough in the middle. The total length of the feed through should be such that each cow or heifer has two and a half to three (2.5-3) feet to itself. The water trough should be placed such that both the young stock and the mature cows have access to it instead of constructing separate trough for each side (the unit divided to separate young and mature stock). Fighting between young stock and cows will not occur due to the boundary created between them. Fighting can also be prevented to constructing vertical poles along the inside of the feed trough at intervals of 2.5 to 3 feet.

The trough can be made of timber or stones. For water, a half drum can be used, each for two cows, instead of constructing a trough. For more than two cows more drums are used as necessary so that water and enough space for each animal is available. If sufficient funds are available both feed and water troughs can be made of bricks and cement (assuming that concrete is more costly in relation to costs of drums and timber). The choice of the materials used for making troughs depends on the costs and availability of materials.

The inside measurements of the feed trough should be 60 cm (2 ft) wide at the bottom and should be raised at least 15 cm (1/2 ft) above the ground level of the walking area. The feed trough should not be too deep or cows will have difficulty reaching feed at the bottom. If it is too shallow, spillage and wastage of feed will occur. The trough is constructed such that its outside is raised to prevent spillage of feed.

A mineral box should be placed centrally in the walking area if not already placed at the head of the cubicle for each animal. This will make it easy for all animals to reach the mineral box



Feed trough

The milking place

The milking place should be constructed next to the cubicles. It should also be of same dimensions as cubicles i.e. 120 cm (4 ft) by 210 cm (7 ft). The floor should be flat and made of firm concrete and slope towards the walking area. The direction of slope of the floor would ensure that dirt collected from the floor can flow through the walking area onto the manure pit. There should be a feed trough at head of milking place for feeding the cows during milking. The milking place should be kept clean. Noise during milking may disturb the cow making it hold back some of her milk.

For a zebu cow, a calf pen should be constructed next to the milking place. This is because most zebu cows let milk down only-when they see their calves. A head yoke is constructed to restrain the animal during milking. Milking place is not optional under semi-zero grazing system. If a farmer chooses to make it optional, then clean milk production is not guaranteed.

The calf pen (optional)

Calf housing is recommended where free suckling is not permitted like in the case of zero-grazing system. The calf pen is situated opposite the milking place. It has a floor surface of 120 cm by 150 cm (4x5 ft). A calf pen can also be situated on the side of a cubicle or milking place. This depends on the type of unit and whether zebus, cross breeds or pure dairy cattle are kept. The floor of the calf pen should be slatted and raised by half to one (1/2-1) foot above the concrete floor. The raised and slatted floor makes it easier to clean the calf pen floor and the concrete under it. The floor under the slats can be concrete or not. The sides should be open to allow for free air flow around the calf pen. They should also be high enough to contain the calf inside. The calf pen can be movable or fixed. The advantage of a movable calf pen is that it can be taken to the family house, for example when the weather is too cold. Beddings are not recommended for a calf pen. They can encourage parasites resulting to disease condition and/or infection of the calf.

The fodder-chopping area (optional)

This place is for a fodder chopping equipment (chaff cutter) and the chopped fodder. It is situated opposite the store next to the calf pen. It is also placed under the roof. The fodder chopping area floor can be made of concrete to avoid the feed getting mixed with soil. A fodder chopper is recommended if there are more than three cows in the unit and where labour on the farm, is generally inadequate. One can chop Napier grass or any other fodder in an open space next to the unit, therefore, a fodder-chopping area is optional.

The store (optional)

If required, a store can be attached to the zero-grazing unit next to the milking place and opposite the fodder-chopping area. In this way, concentrates, minerals, milk utensils and other small equipment can be stored near to the animals. A store is optional where finances are inadequate. It can however be built later-on when funds are available. Inputs like dairy meal and drugs are kept in the living house before a store is built. When building a store, rainwater collection facilities and cemented floor are optional.

Material requirements

Item description	Units	Quantity
Cedar posts 18 ft long	No	24
3" x 3" timber running rails	metres	60
3" x 2" timber running rails	metres	55
2" x 2" timber running rails	metres	50
6" x 2 ½" half board	metres	50
off cuts	pieces	40
corrugate iron sheets 32G, 3m long	No	20
Lorry load hard core 7 tons	No	1
Lorry load ballast 7 tons	No	1
Cement	bags	20

The farmer is advised to use locally available materials such as papyrus mats and eucalyptus trees for roofing.

(b) Improved dairy cattle breeds

In order to increase milk production you need to concentrate on fewer, better fed and better quality animals. Stock the units with dairy cows that have been bred specifically for their high milk yield. Important dairy breeds of cattle for high-milk yield are Friesian, Jersey, Ayrshire and Guernsey. Maintain the dairy breeds by upgrading your stock through artificial insemination using proven dairy-bull semen. Selecting good cows and culling non performing ones coupled with good calf rearing for replacement stock should be an integral part of the system.

(c) Adequate forage resource base

Pasture management and flexibility are the keys to the effectiveness of this system. Planning ahead is critical to ensure there is

always adequate forage available for the animals. Zero grazing can provide opportunities for herd expansion by increased forage utilization or through accessing land beyond cow walking distance for grazing. It is important to think commercially in order to know the maximum forage production potential of your farm holding and the potential amount of off farm forage available to your herd in a given year. This will enable you to determine the maximum number of animals your zero grazing enterprise can support. The amount of forage, whether obtained within or outside the farm, is actually the single most resource that determines the number of cows or animals that can be sustained in the unit because.

(i) In feeding the cows the forage and concentrate, a ratio of 70:30 is recommended.

(ii) Forages take time to establish as opposed to concentrates which can be purchased on demand.

Elephant (Napier) grass *(Penisetum purpureum)* grass is preferred as the main fodder crop because it produces high biomass yield; is easy to grow and re-grows rapidly after cutting. Choose the most suitable fodder to your locality.

Improve soil fertility by recycling all manure on the Napier crop every 2 to 3 days. Harvest the mature Napier grass after it has grown to 60-90cm in height. The aim should always be to produce the highest amount of dry matter (DM) per unit area of fodder grown.

Plant at least 2 acres of Napier grass per mature cow and her offspring. A daily intake of 75-100kg of fresh grass/cow can be achieved with good management to give a dry matter intake of 14-16kg/ day. A fresh weight intake of 100kg/cow/day would be required for 15kg DM of grass.

Other forage grasses recommended under zero-grazing production systems include *Brachiaria* hybrid cv. Mulato (Signal grass), Guatemala, and Setaria. It is recommended to intercrop forage grasses with forage legumes to improve the nutritive quality of the grass. Some of the legumes that can be intercropped with the grasses are: *Centrosema pubescens* (Centro), *Macroptilium atropurpureum* (Siratro), *Clitoria ternatea* (Clitoria)et



Centro



Clitoria



Desmodium



Siratro

Conserve fodder for the dry season to ensure that milk production is maintained at a steady rate throughout the year. One of the greatest problems is providing good quality feed to the herd during the dry season. Fodder may be stored inform of hay or silage.

The increased utilization of off farm fodder can allow for an increase of stocking rate on the farm. You can buy or rent more land for animal feed or purchase feed from neighbors. Invest in a chaff-cutter (forage chopper) to mill crop residues for feed so that you reduce waste. Cows must have adequate feeding space, and wastage must be monitored, to ensure feed intake is maximized. Wastage should be less than 5%, and refused material must be removed from the feeding area daily, as this decomposes rapidly.

(d) Feeding

Cows fed to capacity on grasses alone have the potential to produce up to a maximum of 7 litres of milk per day. Additional milk is supported by concentrates. Please keep in mind that it is pointless to feed supplements when forage requirements are not met.

Concentrates

Give concentrate supplement as the main source of energy and protein. Most farmers prefer giving dairy meal to the cows at milking time. Supplement at a rate of 1 kg for each 1.5 litres of milk the cow produces on top of the 7 Kg of milk contributed by grass. Other concentrates like sunflower seed cake, cotton seed cake and bran are available.

Mixing own concentrate reduces the cost of production and ensures quality supplements. But the most important thing is to have your ration formula right. You will need the skills of a qualified professional to come up with the right mixture of the feeds available to your cows. An example composition of a 100 kg of homemade dairy ration is 16 kg cottonseed cake, 72 kg maize grain, 2 kgs of mineral powder and 10 kgs of calliandra leaf meal. Mineral salt lick should be offered to the cattle ad lib in the mineral box.

Homemade multi-nutrient mineral blocks are lick blocks containing energy, protein, vitamins, minerals and other nutrients. The feeding of the blocks is a convenient and inexpensive method of providing a range of nutrients required by both the rumen microbes and the animal, which may be deficient in the diet. Strategic ruminant supplementation with the multi-nutrient feed blocks is one of the technologies to reduce methane gas which is also responsible for global warming.



Homemade multi-nutrient feed blocks

Use of brewery spent grain as a feeding supplement increases milk production by 2-3litres per day.

Supplementing with forage legumes and fodder trees

Fodder legumes constitute an additional source of protein. Common fodder legumes are *Lablab purpureus* (Lablab)



Lablab

Fodder trees such as *Leucaena* spp, *Calliandra* spp, *Gliricidia* spp. and *Sesbania* spp. are used to increase the protein content of the herd's diet.



Calliandra calothyrsus (Calliandra)





Gliricidia sepium (Gliricidia)

Use of maize stover as a dry season feed

Maize is a staple food crop in smallholder dairy systems and has become increasingly important as a source of feed. Maize stover could therefore be an additional feed resource base for dairy cows especially during the dry season when other feeds are in short supply. The low crude protein content (<5%) of maize stover is however a serious constraint to livestock nutrition. The integration of forage legumes such as *Lablab purpureus* (lablab) cv Rongai into cereal based cropping systems is a promising option for developing sustainable cropping systems.



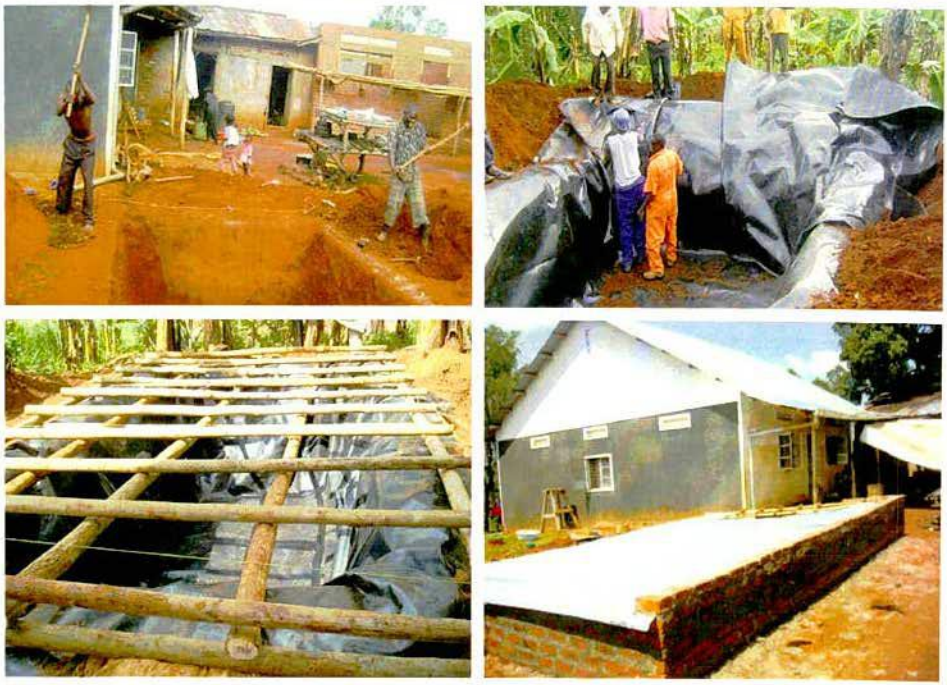
Maize crop intercropped with lablab



Maize grain and stover

Water

Water should be available throughout the day as it makes the bulk of the milk. Harvest water during the rainy season for use during the dry season. Contact the Engineering department of the National Agricultural Research Laboratories, one of the research institutes under the National Agricultural Research Organization (NARO).



Construction of an underground tank (35,000 litres) lined with a dam liner

(e) Stable manure production

Manure should be treated carefully to reap maximum benefit from it. Manure contains high content of organic matter and minerals which improve soil fertility for improved forage yields and is also a source of material for biogas production. Cover the manure pit to prevent nitrogen losses. One cow can produce up to 20 tons of compost per year depending on availability of crop residues. 20 tons of compost contains approximately 80 kg of nitrogen, 40 kg of phosphate and 10 kg of potash. The manure produced from 3 cows is sufficient to produce the amount of gas needed for cooking and lighting in the farm daily

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