FROM EXTENSIVE TO SEMI-INTENSIVE

LIVESTOCK PRODUCTION SYSTEMS IN UGANDA'S ALBERTINE RIFT

PRACTICAL INTERVENTIONS MANUAL



Uganda Wildlife Society and Buliisa District Local Government

Uganda

December 2013

FROM EXTENSIVE TO SEMI-INTENSIVE LIVESTOCK PRODUCTION SYSTEMS IN UGANDA'S ALBERTINE RIFT

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December 2013

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Citation: Rashid Mubiru, Teddy Namirimu, Suzan Owino, Louis Kyalingonza, Priscilla Nyadoi and Joel Buyinza. 2013. From Extensive to Semi-intensive Livestock Production Systems in Uganda's Albertine Rift: Practical Interventions Manual. UWS and BDLG, Uganda.



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This manual has been prepared with the financial assistance from IUCN NL, Wetlands International and BothEnds, partners in the Ecosystem Alliance. The views expressed, the information and material presented and the geographical and geopolitical designations used in this product do not imply the expression of any opinion whatsoever on the part of IUCN NL, Wetlands International or BothEnds or the institutions and organisations providing these three organisations with funds.

CONTENTS

LIST OF TABLES 6

LIST OF FIGURES 7

CHAPTER ONE : INTRODUCTION 8

Background 8

Introduction to Uganda's livestock sector 8

The need for semi intensive livestock production systems in Uganda's Albertine Rift 9

CHAPTER TWO : FORAGE PRODUCTION AND MANAGEMENT 10

Introduction to livestock management for dairy products in Uganda 10

Pasture management 10

Grazing management 11

Fertility management 11

Stocking rates 11

Establishment and management of pastures 11

Fodder crops 12

Forage legumes 15

Fodder trees 15

CHAPTER THREE : HAY AND SILAGE MAKING 16

Introduction to forage conservation 16

Hay making 16

Silage making 20

CHAPTER FOUR : ANIMAL HEALTH AND HYGIENIC MILK HANDLING 27

Introduction to animal health and hygiene 27

Animal health 27

Hygienic milk production 28

Hygienic milk handling, storage, preservation and transportation 30

Legal requirement for milk transportation vessels and carriers.....31
Maintenance of milk handling and cooling equipment.....32
REFERENCES 33
APPENDIX.....34
Situational Analysis of Animal Health Services in Buliisa.....34
Status of Animal diseases.....34
Infrastructure and human power.....35
Organizational setup and activities of veterinary services 36
Drugs and vaccine control.....36
Constraints to provision of veterinary services 37

LIST OF TABLES

Table 2.1: Recommended forage species for western Uganda milk shed 10

Table 4.1: Common livestock diseases and their control measures.....**Error! Bookmark not defined.**

LIST OF FIGURES

Figure 2.1: Planting Napier grass from canes 13
Figure 3.1: Measurements of a baling box 17
Figure 3.2: Key steps in hay making process 18

CHAPTER ONE
INTRODUCTION

Background

Introduction to Uganda's livestock sector

Uganda's livestock sector provides a wide range of animal products that are rich in high quality proteins and have the potential as good and sustainable sources of income in many areas. However, poor livestock production systems and lack of good pasture and fodder, in terms of quality and quantity, are the main constraints to animal production in Uganda. Among others, the different livestock production systems practiced in Uganda includes intensive, extensive and semi intensive systems, each defined in the sections that follow.

Intensive livestock production system

The intensive system is where cattle are enclosed in zero-grazing units and provided with feed and water (Lukuyu *et al.,* 2012). This method is mainly practised in urban or densely populated areas where grazing land is limited. Forage for the cattle can either be grown on farm or purchased. Cattle reared under this system do not waste energy walking in search of pasture, there is no risk of diseases associated with communal grazing and the system accumulates enough manure for fertilizing crops and biogas production. However, the system is labour intensive and requires high initial costs.

Extensive production system

Cattle reared under this system are entirely fed on natural unimproved pasture on grazing lands especially in areas where land is communally owned. This is the predominant production system in Buliisa where animals usually move long distances in such for pasture and water. In such areas cattle go for 2-3 days without water and this greatly stresses them and reduces milk yield and quality. Although this system is cheap and not labour intensive, more grazing is required and it is difficult to accumulate enough manure.

Semi-intensive livestock production system

In the semi-intensive system, cattle graze for some time during the day and in the evening they feed on supplements like Napier grass. This system is a compromise between intensive and extensive systems. Land is not a limiting factor in the intensive system but not sufficient

to allow free grazing. Semi-intensive system is suitable in areas with growing human population and developments that lead to land parcelling.

The need for semi intensive and other forms of less extensive livestock production systems in Uganda's Albertine Rift

The Albertine Rift region, though known for its rich biodiversity, is currently experiencing new developments such as oil discovery and with the associated production activities. These developments have come in with demand for land use changes and parcelling that have impacts on the communities' livelihoods and underlying production systems. For example, in Buliisa district where land has been largely held under communal/common property regimes, for security of ownership and ensuring benefits to communities, oil developments have brought about the need for land use change, land parcelling and disruption of extensive livestock production systems.

The demand and pressure is building up for livestock farmers in Buliisa to stop free range rearing of cattle i.e. extensive production system. Not only is this livestock management practice viewed as a problem to emerging developments, but it has also been the main cause of resource use and management conflicts between the cattle keepers, fisher folk and crop farming communities in the district. Moreover, the extensive livestock production system also does not give optimal returns for the cattle keepers. Under proper management, a cow produces on average 2.5 litres of milk per day for a period of 200 days but in Buliisa district the farmers get on average one litre per day. Thus, interventions to encourage these farmers to change management system so as to improve productivity of their livestock were worthwhile.

It is against the above background that Uganda Wildlife Society embarked on promoting a range of livestock management technologies with the hope that if adopted would enable livestock production improvement in a semi -intensive manner in the district. This Practical Interventions Manual describes selected technologies that farmers could consider to adopt for improved management and productivity of livestock.

CHAPTER TWO

FORAGE PRODUCTION AND MANAGEMENT

Livestock management for dairy products in Uganda

Inadequate high-quality forages is one of the major constraints to livestock farming for dairy products in Uganda and the East Africa region (Lukuyu *et al.,* 2012). There are several species of plants cultivated for feed/fodder for livestock in Uganda, which are grazed or cut and fed as fresh green fodder or conserved and fed as hay or silage to the animals. The different forage species have specific agronomic requirements that in part determine where they are adopted for animal feed. The table below shows the forage species for diary production in Uganda's Albertine region and their agronomic requirements.

Table 2.1: Recommended forage species for western Uganda (Kabarole, Kasese and Buliisa district)

Grasses	**Legumes**	**Fodder**	**Grass/Legume mixture**
Chloris gayana (Rhodes grass)	*Desmodium intortum* (Green Desmodium)	*Pennisetum purpureum*	*Panicum maximum,*
Brachiaria ruzinziensis (Ruzi grass)	*Desmodium uncinatum* (Silver leaf desmodium)	*T.Laxum*	*Chloris gayana*
Pennissetum clandestinum (Kikuyu grass)	*Neonotonia wightii* (Neonotonia)	*Leucaena leucocephala*	*Desmodium intortum*
	Macroptilium atropurpureum (Siratro)	*Medicago sativa* (Lucerne/Alfalfa)	*Neonotonia wighii*
	Stylosanthes guyanensis (Stylo)	*Dolichos lablab* (Lablab bean)	*Brachiaria ruzinziensis*
		Cajanus cajan	*Desmodium uncinatum*
			Macroptilium atropurpureum

Source: Buliisa District Veterinary Office 2013

Pasture management

Efficient pasture management results in high yields of good-quality pasture that can be fed to cattle for high milk production. Management activities including weed control, grazing and fertility management are fundamental. This is because weeds compete with and reduce the productivity of the sown pastures, particularly during the establishment year, and should be controlled during the first year by hand weeding. In the subsequent years fields can be kept clean by slashing and hand pulling the weeds.

Grazing management

During the establishment year, grasses usually reach the early flowering stage between 3–4 months after planting. At this stage the plant is not firmly anchored in the soil therefore it is advisable to make hay out of the grass rather than graze the pastures. Otherwise the grass will be exposed to the risk of the cattle pulling out the young shoots. For maximum benefits, use the pasture not later than the start of the flowering stage. Graze or cut at intervals of 4 to 6 weeks, leaving stubble at 5 cm height. On average, one animal will need 1–2 acres of improved pasture per year in areas receiving over 900 mm rainfall. It is advisable that the farmer conserves excess pasture in the form of hay for dry-season feeding.

Fertility management

Maximum production from pasture requires additional nutrients from farmyard manure. During the establishment year, soil nitrogen is adequate for grass productivity. However, in subsequent seasons, apply 5–10 tonnes of farmyard manure per hectare per year in three splits during the rainy season. Nitrogen fertilizer may be applied at 1 or 2 months before the dry season in order to increase yields during the dry season.

Stocking rates

Stocking rate is the number of animals (animal unit) for which a grassland unit (hectare) can provide adequate dry-matter forage for a specified length of time. Stocking rate influences animal performance, pasture recovery, long-term pasture production and long-term pasture species composition. Stocking rates should represent a balance between grazing pressure (pasture demand) and carrying capacity (pasture supply). The main goal should be to optimize both animal and pasture production over the long term, as opposed to maximizing only one or the other. In general, improved pastures can support higher stocking rates than native or unimproved pastures.

Establishment and management of pastures

Pasture establishment can be by direct sowing, under sowing or over sowing. During direct sowing, the pasture grasses are established without any cover crop, usually recommended as early as possible in the rainy season. In areas that receive bimodal rainfall like Buliisa

district, it is advisable to sow during the short rains (August – October) to eliminate annual weeds. Endeavour to sow the seeds close to the surface to enable them access moist soil so they will absorb moisture and germinate. Do not bury the seeds deep because the initial vigour is not sufficient to push through a heavy soil.

Under sowing is a method of establishing pastures under a cover crop. The cover crop is grown together with pasture for economical land use. The crop is harvested after maturity while the pasture is left for 2 to 3 years to mature. Where maize is the cover crop, broadcast pasture seed mixed with phosphate fertilizer in the maize field after the second weeding of maize (usually 4 to 5 weeks after planting maize) or when maize is knee high. After harvesting the cover crop, remove straws and cut back the weeds using a panga or slasher.

Over sowing is the introduction of improved pasture species (grasses or legumes) to a natural pasture. This is the easiest and most cost-efficient strategy for improving natural pasture. Although both grasses and legumes may be over sown, legumes are more suitable, as grasses do not establish readily, especially on soils that are not loose. Over sowing should be done in areas where soils are light and loose. Benefits become evident after about 2 years. However, this method can only apply in Buliisa district if the land is paddocked, otherwise the land tenure (communal land tenure) cannot favour over sowing. Therefore it is advisable that livestock farmers establish paddocks on their land.

Fodder crops

Fodder crops are cultivated on arable land and grazed or fed to stock either green or in a conserved form like hay or silage. Fodder crops are usually grown in rotation with cultivated cash crops. They are characterized by their high productivity per hectare (dry matter yield) compared with permanent pastures. These crops are grown as supplementary feeds during the dry months of the year. The most common are;

- Napier grass *(Pennisetum purpureum)*
- Sweet potato vines *(Ipomea batatas)*
- Fodder sorghums *(Sorghum sudanense)*

Napier grass

Commonly grown Napier grass varieties include; (a) Bana grass, usually leafy and with few silica hairs, which cause irritation during handling, (b) Clone 13, is resistant to white mould disease and a high yielder but its thin stems make it difficult to establish, (c) French Cameroon, is a high yielder, established easily from canes, (d) Kakamega 1 and 2, both are high yielders though Kakamega 1 has a higher growth rate than Kakamega 2 and (e) Pakistan hybrid, which does well in dry areas like Buliisa.

Planting:

Napier grass can be established from root splits or canes. It can also be planted alone or intercropped with forage legumes. The conventional method of planting Napier grass involves planting one cane (with 3–4 nodes) in holes 15–30 cm deep (*Figure 2.1*). The recommended spacing is 1 m x 0.5 m in areas like Buliisa district with 950–1400 mm rainfall. When cane cuttings are used, bury the nodes, leaving one node above the soil surface.

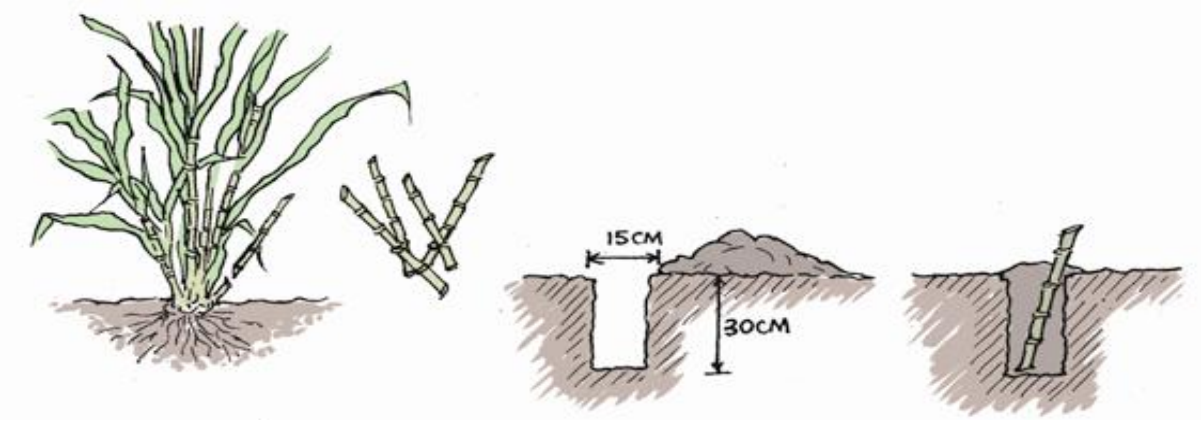


Figure 2.1: Planting Napier grass from canes (Source: Lukuyu *et al.*, 2012)

Other forage legumes like silver leaf (*Desmodium uncinatum*), green leaf (*Desmodium intortum*) and stylo (*Stylosanthes guianensis*) can be intercropped with Napier grass to improve the quality of the feed and reduce the cost of manure needed to fertilize the soil. Legume seeds at the rate of 3–5 kg/ha can be drilled along the Napier grass rows or between the rows when the Napier grass is planted.

Management:

Harvest when 1 m high or every 6–8 weeks to obtain optimal quality and quantity. Always maintain a height of 5–10 cm from the ground level at each harvest to avoid weakening the root system, which leads to low production in subsequent harvests.

Sweet potato vines

Sweet potato vines have a higher nutrient content than Napier grass and are normally fed to cattle as a supplement. They are particularly recommended for calves because they increase the growth rate and promote rumen development. They are also good for recently calved and sick animals. They increase milk yield when fed to lactating cows though their main setback is high moisture content.

Planting:

Plant sweet potato vine cuttings (30 cm long) at a spacing of 90 cm between rows and 30 cm within rows. Vines may also be planted in ridges, mount or flat. For fodder production ridging or mounting has no advantage. The first harvest should be done when the vines cover the ground; this is usually 4–5 months after planting.

Fodder sorghums

Sorghums are drought resistant and grow well in dry areas. Sudan grass and Columbus grass varieties are recommended for the drier parts like Buliisa district. Sorghums require well-prepared seedbed to ensure even germination and planting should be at the start of the rains.

Planting:

A planting requirement of 25–35 kg of sorghum seed per hectare is needed at a spacing of 30–40 cm from row to row or broadcast.

Management:

Sorghums should be cut every 6–8 weeks; after 5–6 cuttings it becomes uneconomical to maintain the crop and it should be ploughed. The quantities required to feed a dairy cow per day are the same as for Napier grass.

Note: Do not graze sorghum earlier than 6 weeks to avoid prussic acid poisoning.

Forage legumes

Forage legumes play an important role in the smallholder farming system as they improve soil fertility through nitrogen fixation; have high crude protein in the leaves and foliage, which can be used as a protein supplement for cattle. They are rich in minerals (calcium, phosphorus) and vitamins A and D (Lukuyu *et al.,* 2012). The most common forage legumes include desmodium and *Dolichos lablab.*

Fodder trees

Fodder trees are used by small-scale dairy farmers as a cheap source of protein for dairy cows. Common types of fodder trees include *Calliandra calothyrsus, Leucaena, Ficus natalensis and Sesbania sesban.* Leaves of fodder trees provide good feed for cows; they are a good supplement to straw and poor grass diets and provide high quality forage for the dry season.

A well established *Calliandra* stand can be harvested 4 to 5 times a year with the harvesting interval varying with rainfall. Always cut again when the re-growth is 50–60 cm. Depending on rainfall and soil fertility, dry matter yields range from 5 to 10 t/ha per year.

CHAPTER THREE

HAY AND SILAGE MAKING

Introduction to forage conservation

Forage conservation is important because rain-based pasture and fodder production is seasonal, and there are times of plenty and times of scarcity of pasture. It is thus imperative to conserve any excess for use in times of dry season scarcity. The aim of conservation is to harvest the maximum amount of dry matter from a given area and at an optimum stage for utilization by animals. It also allows for regeneration of the forage. The two main ways of conserving fodder are by making hay or making silage.

Hay making

Hay is fodder conserved through drying to reduce the amount of water content so that it can be stored without rotting or becoming mouldy. Reducing the moisture content slows down the rate of growth of spoilage microorganisms. Hay is dried forage used to feed livestock during the dry season or during drought when pastures are scarce. The moisture content should be reduced to about 15%. Not all grasses and fodder are suitable for haymaking. Hay can be made out of grass, legumes or a mixture and these can be natural and planted grasses.

The grasses suitable for hay making include *Brachiaria ruziziensis* (Ruzi), *Brachiiaria brizantha* (Common signal grass), *Chloris guyana* (Rhodes grass), *Cynodon dactylon* (Common star grass), *Panicum maximum* (Common guinea grass), *Setaria anceps* (Nandi grass), *Hyparrhenia rufa* (Thatching grass), *Pennisetum cladestimum* (Kikuyu grass), *Cenchrus ciliaris* (Buffel grass) and *Themeda triadra* (Red oat grass).

Fodder legumes suitable for hay making include *Leuceaena leucocephala*, *Medicago sativa* (Lucerne /Alfalfa), *Dolichos lablab* (Lablab bean) and *Sesbania sesban*. Different types of hey can be made from these grasses and this include Long hay, Chopped hay, Baled hay (their shape sheds rain and resists water better than traditional bales) and Dried grass - Barn-dried hay.

Harvesting and curing

1. Harvest the fodder for haymaking when the crop has attained 50% flowering. At this stage protein and digestibility are at maximum, after which they decline with age.
2. The fodder should be harvested after 2 to 3 days of dry weather so that drying will be possible.
3. Where possible, drying should be done under shade so that the dried fodder retains its green colour, which is an indicator of quality.
4. Turn the fodder using a farm fork to ensure even drying.
5. Check the dryness by trying to break the stem. If it bends too much without breaking, there is still too much water.
6. Legumes and grasses can be mixed to make better-quality hay, e.g. Rhodes grass.

Baling hay

Baling the hay allows more material to be stored in a given space. A good estimate of the amount stored makes feed budgeting easier. Baling can be manual or mechanized, manual baling being more economical for small-scale dairy farmers. Manual hay baling is done using a baling box measuring 85 cm long x 55 cm wide x 45 cm deep, open on both ends (*Figure 3.1*). If the hay is well pressed, the box will produce an average bale of 20 kg.

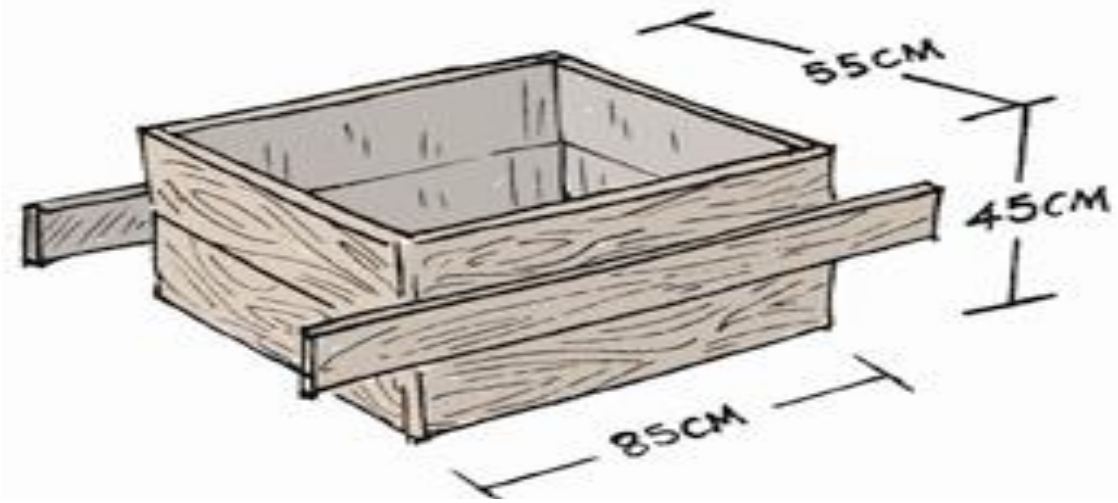


Figure 3.1: Dimensions of a baling box (Source: Lukuyu *et al.*, 2012).

The major steps involved in making hay include harvesting grass, drying, baling, filling the hay box, compacting of the grass, tying grass to keep it intact, releasing of the hay bale, weighing it and ensuring good storage. These steps are demonstrated in Figure 3.2 below.



Step 1: Harvest the grass at flowering stage using either a sickle or panga.



Step 2: Dry the harvested grass for about 1-3 days depending on the weather.



Step 3: Prepare the box for baling with strings running in easting and northings.



Step 4: Fill the hay box with harvested dry grass.



Step 5: Compact the grass in the box by stepping on it.



Step 6: Tie the strings to avoid the grass from falling out.



Step 7: The box is lifted and the hay bale is released.



Step 8: Weigh the bale before storage.



Step 9: Ready hay bales for storage.



Step 10: Hay store for future use.

Hay storage

Hay can be kept for long periods if properly made and correctly stored; however it can deteriorate rapidly and even be lost due to careless storage. Hay must be properly stored, dried and protected from wastage due to rots, pests, stray livestock, fire or wind. The storage facility should be elevated to protect the hay from running water and termites (Step 10 in Figures 3.2 above). The floor should be aerated to allow even drying of the bales while in storage. The quality of the hay should be marked on physical examination. Good quality hay should be leafy and greenish in colour, have no foreign material mixed with it and have no bad smell.

How to feed hay

Hay can be fed to beef cattle, dairy cattle, goats and sheep. Intake will depend on hay quality and availability of other feeds. Since hay contains 85% dry matter, if a cow consumes nothing else, it will require 14 kg of hay per day. Give a cow 7-13 kg of hay and 3-5 kg of legume hay if prepared separately; a heifer will consume 5-9 kg of grass hay and 1-3 kg of legume while a young dairy cow will consume 2-3 kg of grasses and 1 kg of legume per day.

Amount of hay fed to the animal must be monitored so that animals do not get too fat or too thin. Supplemental feed may be required for working animals with high energy requirements. Before feeding the hay can be sprinkled with urea, molasses or salty water to facilitate intake.

Animals that eat spoiled hay may develop a variety of illnesses, from coughs related to dust and mold, to various other illnesses, the most serious of which may be botulism, which can occur if a small animal, such as a rodent or snake, is killed by the baling equipment, then rots inside the bale, causing a toxin to form.

Silage making

Silage is high-moisture fodder preserved through fermentation in the absence of air. These are fodders that would deteriorate in quality if allowed to dry. Silage can be made from grasses, fodder sorghum, green maize or Napier grass. An ideal crop for silage making should contain an adequate level of fermentable sugars in the form of water-soluble

carbohydrates, have dry matter content in the fresh crop of above 20% and, possess a physical structure that will allow it to compact readily in the silo after harvesting.

Crops that do not fulfil these requirements may require pre-treatment such as field wilting to reduce moisture, fine chopping to a length of 2–2.5 cm to allow compaction and use of additives to increase soluble carbohydrates. The dry matter yield of common fodders used for silage making is 4–12 t/acre for Napier grass, 6.8–8.8 t/acre for sorghum E6518 and 9.6 tonnes per acre for maize.

Harvesting stages

Napier grass should be harvested when it is about 1 m high and its protein content is about 10%. Maize and sorghum should be harvested at dough stage, that is, when the grain is milky. At this stage, maize and sorghum grains have enough water-soluble sugars so it is not necessary to add molasses when ensiling. However, when ensiling Napier grass, it is necessary to add molasses to increase the sugar content. To improve silage quality, poultry waste and legumes like lucerne and desmodium may be mixed with the material being ensiled to increase the level of crude protein. Since protein has a buffering effect that increases the amount of acid required to lower the pH, poultry waste and legumes that have been incorporated need to be within limit. Poultry litter should not exceed 5% and legumes should not exceed 25% of the total material ensiled.

Types of silos

A silo is an airtight place or receptacle for preserving green feed for future feeding on the farm. Silos can be either underground or above ground, the qualification being that the silo must allow compaction and be airtight. Five types are described here: tube, pit, above-ground, trench and tower.

- Silage can be made in large plastic sacks or tubes. The plastic must have no holes to ensure no air enters. This is popularly referred to as tube silage.
- Silage can also be made in pits that are dug vertically into the ground and then filled and compacted with the silage material.
- An above-ground silo is made on slightly sloping ground. The material is compacted and covered with a polythene sheet and a layer of soil is added at the top. When

finished, it should be dome shaped so that it does not allow water to settle at the top but rather collect at the sides and drain away down the slope.

- Trench silo is an adaptation of the pit silo that has long been in use. It is much cheaper to construct than a pit silo. Construction is done on sloping land. A trench is dug and then filled with silage material. This method is ideal for large-scale farms where tractors are used. Drainage from rain is also controlled to avoid spoiling the silage.
- Tower silos are cylindrical and made above the ground. They are 10 m or more in height and 3 m or more in diameter. Tower silos containing silage are usually unloaded from the top of the pile. The advantage of tower silos is that the silage tends to pack well due to its own weight, except for the top few metres.

Tube silage:

The following are key steps in making tube silage:

1. Chop the wilted material to be ensiled into pieces not more than 2.5 cm long
2. Sprinkle the chopped material with a molasses and water mixture; for every sack use 1 litre of molasses mixed with 2–3 times as much water. This is especially for material like Napier grass that has low sugar content. Maize bran or cassava flour can be added to improve the carbohydrate (energy) content.
3. Place the chopped material, sprinkled with the molasses and water mixture, into the plastic tubing (1000 gauge) with a width of 1.5 m. Cut a 2.5-m length, tie off one end and fill with the material, compressing it well, then tie the other end to seal. Stack the filled sacks until needed. Fermentation is usually complete after 21 days.

Advantages of tube silage

- Plastics silage bags are an economical alternative to traditional silage storage systems, such as pits and silos when related, harvest and storage losses are considered.
- It is an effective way for preserving feed with minimum nutrient loss. (The anaerobic environment that is created eliminates spoilage from the growth of yeasts, moulds and adverse bacteria while maintaining essential proteins and nutrients).
- Allows farmers to store silage anywhere they need it. A well graded and well drained ground surface is all that is necessary.

- The silage is completely sealed in the bag and this means all the acid is retained in it unlike in pit silage where, the acid seeps out through the bottom of the pit as effluent.
- 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 pits 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.

Disadvantages of tube silage

There are a few disadvantages of using silage bags. Among them are:

- The importance of pest control to prevent damage on the bags.
- Containment and disposal of the plastic, once silage is removed from the bag.
- The need to chop the green mass, as chopped material tends to make much better silage, because more air can be squeezed out of it during the packing process, and the small pieces cannot puncture the bag.

Qualities of good silage

Well-prepared silage is bright or light yellow-green, has a smell similar to vinegar and has a firm texture. Bad silage tends to smell similar to rancid butter or ammonia. Natural microorganisms ferment the sugars in the plant material and in the added molasses into weak acids, which then act as a preservative. The result is a sweet-smelling, moist feed that cattle like to eat once they get used to it.

Storage and feeding

Tube silage should be stored under shade, for example in a store. Rats and other rodents that could tear the tube need to be controlled. When feeding, open the tube and scoop a layer and remember to re-tie without trapping air inside.

When feeding from the pit, scoop in layers and cover after removing the day's ration while making sure that the pit is airtight. Drainage from the top should be guided to avoid rainwater draining into the pit.

When feeding from the above-ground method, open from the lower side of the slope, remove the amount you need for the day and re-cover it without trapping air inside.

To avoid off-flavours in milk, feed silage to milking cows after milking, not before, or feed at least 2 hours before milking.

Losses

Nutrient losses may occur during silage making. In the field during cutting, losses due to respiration during wilting will be about 2% per day. If it rains, leaching may cause some loss.

• Overheating due to poor sealing gives a brown product, which may smell like tobacco and result in severe damage to nutrients, e.g. proteins.

• Effluent losses of 2–10% that occur from moisture seepage contain soluble and highly digestible nutrients; seepage should be avoided by wilting the herbage.

Silage additives

During silage preparation, different types of additives can be incorporated to improve the quality. These include *fermentation stimulants*. Some crops may not contain the right type or the right number of lactic acid bacteria. Bacterial inoculants and enzymes can hasten and improve fermentation by converting carbohydrates to lactic acid. Most inoculants contain *Lactobacillus plantarum*.

Fermentation inhibitors include acids such as propionic, formic and sulphuric. Inorganic acids are more effective but are strongly corrosive thus not recommended. Of the organic acids, formic is more effective than propionic, lactic or acetic.

Substrate or nutrient sources (grains, molasses, urea or ammonia) are used when there are insufficient soluble carbohydrates in the material to be ensiled (e.g. legumes, Napier grass, crop residues). They are also used to increase the nutritive value of the silage. Molasses can be added at the rate of about 9 kg/t of silage.

Note: Use of additives is not a prerequisite for making good silage, but it is good for crops such Napier grass, lucerne and grasses such as *Cynodon dactylon* (star grass), *Brachiaria brizantha* (signal grass), and *Setaria sphacelata* (bristle grass) because it improves fermentation and nutritive value of the product.

Improving the quality of crop residues

Several methods have been developed to improve the quality of crop residues, but chemical treatment has received the most attention.

Physical methods

Chopping straw to 5 cm or a little longer before feeding is a common practice. Scientific tests have shown that chopping does not improve straw digestibility, but it does increase intake, reduce wastage and make it easy to mix the straw with other feed components.

There is also the salting method, in which chopped straw is soaked in a dilute salt solution before feeding. Although this method has not been scientifically tested, many farmers practice and considering it to be effective.

Supplementation

Supplementation of crop residues with grasses, legumes or concentrate feeds significantly improves feed intake and animal performance. In dryland farming systems where forages are scarce, crop residues are supplemented with concentrate feeds. Supplementation of the basal diet with good-quality forage or concentrates helps to overcome the problem of low palatability.

Urea treatment

Treating crop residues with 4% urea solution at 45–50% moisture improves the nutritive value by increasing the digestibility, palatability and crude protein content. The process is simple and farmers can easily practice it. The chopped material is soaked in urea solution mixed at the rate of 4 kg urea (fertilizer grade) in 100 litres of water (4%). The urea-water solution is sprinkled on batches of the chopped material as it is added to the pit. After each addition, the mixing should be thorough. The mixing can be done in the pit or on a plastic sheet on the ground before packing the pit. It is commonly recommended that the pit should

remain closed for at least 3 weeks and preferably 1 month, but treatment times longer than necessary do not have any adverse effects.

The urea is converted to ammonia, which then breaks down some of the bonds in the fibrous material, thus making them accessible to microbial enzymes.

Note: There are three questions to take into account before embarking on hay or silage making program:

- Is there a need for hay or silage in your area?
- Are there enough good quality forages or agricultural and industrial by-products available in your area to be ensiled?
- Can the conditions for good hay or silage making be met?

CHAPTER FOUR

ANIMAL HEALTH AND HYGIENIC MILK HANDLING

Introduction to animal health and hygiene

Raising dairy cattle and processing milk provide a steady and important source of income. Every Ugandan consumes an average of 28 liters of milk per year with variations in households and regions (Staal and Kaguongo, 2003). In 1992 government launched a Milk Master Plan to simultaneously improve rural incomes, farm living standard, national self sufficiency in milk production and yields of surplus milk for export. Diary Development Authority (DDA) was established in 1998 to realize the objectives of the Master plan. Potential local milk supply and demand in Uganda indicates a clear pattern of fluctuating net milk surplus and deficit. Milk production is calculated by assessing the number and type of dairy in an administrative area and estimating the liters of milk produced within that area based on average milk production per cow. Demand for milk is calculated by estimating the average milk consumption per person nationally and applying that number to the population density of the area.

Areas with more milk produced than could be theoretically be consumed by the population are considered to be ‘surplus' areas. Despite the large herds of cattle in Buliisa, the district is not ranked among the milk ‘surplus’ areas in Uganda. Due to the high levels of poverty and shortfall of milk, investment in dairy farming could potentially help poor households out of poverty and improve local milk supply with nutritional benefits to the households. Diary investments in Buliisa district need to take an innovative ‘Dairy value chain’ approach that aims at expanding the opportunities for farmers, traders, transporters, processors and consumers.

Animal health

Livestock pests and diseases are the major constraints in improving livestock productivity. Common livestock diseases in Uganda are contagious bovine pleuropneumonia (CBPP), trypanosomiasis, foot and mouth disease (FMD), tick borne diseases mainly East Coast fever, rabies, brucellosis, black quarter, anthrax and lumpy skin disease. Tick-borne diseases, especially East Coast fever, present the biggest health problems for dairy cattle

(MAAIF/ILRI, 1996). Diseases impose a heavy cost on farmers and reduce incentives in investing in higher yielding cross breeds or exotic animals that tend to be more vulnerable.

Many farmers, practice disease prevention measures including regular spraying and/or dipping of dairy cattle with acaricide (Table 4.1). There have been efforts to introduce the infection-and-treatment method in Uganda, particularly in areas of the southwest where grazing is prevalent (Staal and Kaguongo, 2003). These have been hampered by the deaths of some cattle and caused loss of confidence by farmers in the method. Preventive treatment of trypanosomiasis is also done as considered appropriate. Regular vaccination against rinderpest and contagious bovine pleuro-pneumonia are done by the Department of Veterinary Services and Animal Industry (DVSAI), with the assistance of government and donor funds.

Table 4:1 Common diseases of livestock and control measures

Vector borne diseases	**Control measures**
▪ Lumpy skin disease ▪ Pseudo lumpy skin disease or mammillitis ▪ Ephemeral fever ▪ Rabies ▪ Rift valley fever ▪ Trypanosomiasis	▪ Restriction of movements ▪ Use of chemotherapeutics drugs ▪ Tick control by use of acaricides ▪ Vaccination control strategy ▪ Tsetse fly control with Samorin-Berenil combination, Spraying and traps
Viral diseases	
▪ Foot and Mouth Diseases (FMD) ▪ Bovine Viral Diarrhea/ Mucosal Diseases ▪ Infectious Bovine Rhinotraccheitis ▪ Bovine Papular stomatitis	▪ Restriction of movements ▪ Use of chemotherapeutics drugs ▪ Vaccination control strategy
Bacterial Diseases	
▪ CBPP ▪ Bovine Cutenous Strepthricosis ▪ Pasteurellosis ▪ Pnuemonia ▪ Calf scours ▪ Black quarter	▪ Restriction of movements ▪ Use of chemotherapeutics drugs ▪ Tick control by use of acaricides ▪ Vaccination control strategy
Soil borne infections	
▪ Anthrax ▪ Clostridia diseases ▪ Johnes'Diseases (Paratuberclosis) ▪ Salmonellosis	▪ Restriction of movements ▪ Use of chemotherapeutics drugs ▪ Vaccination control strategy
Reproductive diseases	
▪ Brucellosis ▪ Vibriosis (Bovine Genital Vibriosis) ▪ Leptospirosis	▪ Restriction of movements ▪ Use of chemotherapeutics drugs ▪ Tick control by use of acaricides ▪ Vaccination control strategy ▪ Routine herd health practices
Internal parasites	
▪ Helminthosis ▪ Nematodes ▪ Trematodes ▪ Cestodes	▪ Restriction of movements from clean pastures to contaminated pastures ▪ Use of chemotherapeutics drugs ▪ Routine deworming practices

Hygienic milk production

Milk from the udder of a healthy cow contains very few bacteria. Poor hygiene introduces additional bacteria that cause the milk to get spoilt very quickly. To ensure that raw milk remains fresh for a longer time, good hygiene must be observed during milking and handling.

Hygienic milking

Good hygiene and quality control needs to be observed at all stages of milk production, handling and sale. Therefore hygienic practice must begin at farm level to ensure that the milk you handle is clean and has low levels of spoilage bacteria. To ensure good quality:

- Maintain clean and healthy cows.
- Keep a clean milking environment free of dust and mud.
- Do not milk cows if you are suffering from communicable diseases like diarrhoea or typhoid.
- Do not mix colostrums (milk produced for the first seven days after calving) with normal milk.
- Wash your hands with soap and clean water before milking.
- Wash the udder with a clean cloth and warm water.
- Dry the udder with a clean cloth.
- Use clean containers for milking.
- Milk from cows under antibiotic treatment should not be sold until 3 days after last treatment or as advised by the veterinary practitioner.
- During milking, the milker should not
  (a) have long nails, (b) sneeze, spit or cough, (c) smoke.
- Release the cow from the milking area as soon as milking is finished.
- Sieve the milk through a strainer/ clean cloth to remove solid particles that may have fallen in during milking.
- Cover the milk to avoid contamination and move to a clean and cool area.

Hygienic milk handling, storage, preservation and transportation

Causes of milk spoilage

Milk is very rich in nutrients, because of this, the bacteria that causes spoilage can grow quickly in milk. If milk is stored at high temperature for a long time, the bacteria will grow and multiply very fast and get spoilt quickly.

Some of the guidelines to follow in order to avoid milk spoilage:

- Always handle milk in clean containers.
- When transferring milk between containers, pour the milk instead of scooping. Scooping may introduce spoilage bacteria in the milk.
- Do not store milk at high temperature.
- Avoid keeping milk for a long time before it is delivered to the milk collection point or processing factory.
- Do not handle milk if you are sick or suffering from communicable and infectious diseases.

Equipment for milk handling and storage

- Always use certified food grade containers e.g. aluminium, stainless steel. Metal containers are preferable because they are easy to clean and sterilize.
- Do not store milk in plastic jerry cans that previously contained paint, herbicides and other chemicals because traces of these substances can contaminate the milk.

Safe use of cleaning and sanitation detergents

There are various types of cleaning and sanitation agents that have been specially designed to clean and disinfect milk handling equipment. You may also use liquid soap which is a good cleaning agent. Always rinse your equipment properly after cleaning to prevent detergent residues from contaminating the milk.

Procedure for cleaning of milk containers

Before re-using the milk container:

- Pre- rinse the container soon after use.
- Thoroughly scrub the container with warm water and detergent or soap (using a stiff bristled hand brush or scouring pad.

- Rinse the container in clean running water.
- Dip rinse the container in boiling water for at least one minute to kill germs or pour hot water into it.
- Air dry the container in an inverted position on a clean rack in the open.

Appropriate milk transportation equipment

For small quantities of milk, the ideal milk transportation equipment would be metal milk containers made from stainless steel or aluminium. Such containers are made from approved food grade material and are also durable, easy to clean and sanitise. The container should have a lockable lid to prevent spillage due to dirt and contamination.

Larger quantities of milk requires insulated bulk tankers. These are more expensive and require special additional equipment like pumps which should also be thoroughly cleaned.

Legal requirement for milk transportation vessels and carriers

Ensuring that all stakeholders handle milk appropriately requires an efficient regulatory mechanism to control their activities, but also requires that standards are set appropriately and practically, and incentives are provided for compliance (Staal and Kaguongo, 2003). Uganda lacks an efficient regulatory mechanism despite existing laws such as in the Dairy Industry Act of 1998, which provides for the processing and marketing standards. This stems from the observation that regulations are commonly ignored, attributed to light penalties and constraints to law enforcement. A more successful approach to raising standards is likely to be achieved through engaging directly with the primary market agents (small scale in the case of Uganda) to match standards with their ability to comply. The DDA has taken positive steps to engage directly with small-scale traders.

The legal requirements of milk transportation vary from country to country. However you can contact Diary Development Authority (DDA) to find out the specific licenses, certificates and permits that you need. Documents must be valid and may include:

- Certificate of registration with DDA.
- Certificate from the national transport licensing board.
- Public health licence.
- Road licence.
- Motor vehicle third party insurance certificate.

You should also follow the code of hygienic practice and other laws that relate to milk hygiene e.g. approved milk containers, use of chemical preservatives, medical examinations for milk handlers, environmental management and waste disposal.

Maintenance of milk handling and cooling equipment

For best use of milk cooling equipment, it is important to adhere to the following:

- Avoid opening the milk cooler unnecessarily to prevent warm air from entering it.
- Ensure that the evaporator is well ventilated so that the cooler functions properly.
- Ensure that the cooler always has enough refrigerant in the system.
- Connect the cooler to a voltage stabiliser to provide for a constant supply of electricity
- Set up schedules for cleaning and preventive maintenance and ensure that they are followed. Any mechanical repairs should be carried out by a trained technician.
- Have a stand by generator in case of power failure.

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APPENDIX

Situational Analysis of Animal Health Services in Buliisa District

Buliisa has an enormous livestock resource with a total contribution of about 10% of Gross Domestic Product and 17% of the agricultural output. Recent UBOS estimates show that there are 34,820 heads of cattle owned by 1,120 households, 47,206 sheep and goats owned by 5,760 households, 850 pigs and over 99,930 poultry birds in Buliisa (UBOS, 2008). The population of dogs and cats are 6,630; however in every 5 households at least 3 households in the rural area own one or two dogs and a cat. Livestock is the main source of livelihood (in form of meat, milk and egg, and source of cash income). Livestock contribution to the people's livelihoods however are constrained by lack of sufficient and standard nutrition, poor husbandry practices, lack of marketing facilities and opportunities, inadequate animal health services (treatment practices, disease control activities, reporting systems, standard treatment guidelines) and uncoordinated development programs between various levels of government institutions and/or non-governmental organizations.

The presence of many diseases has resulted in low productivity and a significant obstacle to international market access. Lack of regulation on livestock movement, disease reporting system, drug and vaccine production, distribution and handling have remained major deficiencies for many years. The government of Uganda and Local governments are undertaking slow but organized action to improve animal health delivery system through legislations, manpower development and information dissemination. The major activities are: control of disease through organized activities between the two government strata, improving disease reporting system, training of different levels of animal health professionals, improving the existing legislations and formulating new ones for disease control, establishment and standardization of veterinary drugs outlets, laboratories and training institutions. Veterinary drug, biological production, importation, use and quality control have been given much attention by the National Drugs Authority.

Status of Animal diseases

Animal diseases are of major concern at both the Central and Local government levels. Their main negative effects of are: loss of production and productivity, hindrance to gain access to the international animal and animal products' markets, reduction in the quality of hides and

skins, tick borne diseases constraints to improving the genetic potential through cross breeding with exotic breeds, and their zoonotic potential. In Uganda, the direct loss resulting from mortality of food animals due to infectious diseases is estimated to be 8-10% of cattle, 14-16% of sheep, and 11-13% of goats. However, statistics on indirect losses are not available.

According to the *Office International des Epizooties*, animal diseases are categorized into two as List A and List B diseases. List A are the communicable diseases which have the potential for very serious and rapid spread, irrespective of national borders. These are of serious socioeconomic or public health consequences and are of major importance in the international trade of animals and animal products. Apart from their economic and public health significance at national level, these diseases have major impact on international animal market. Among the 15 List A diseases, 8 are currently confirmed to be prevalent in Uganda. These include foot and mouth disease, *peste des petits* ruminants, contagious bovine pleuropneumonia, lumpy skin disease, bluetongue, sheep pox and goat pox, and Newcastle disease. Rinderpest which was rampant for over a century, has recently been eradicated from Uganda. List B includes communicable diseases, which are considered to be of socio-economic, and/or public health importance within countries and which are significant in the international trade of animals and animal products. More than 83% of these diseases are confirmed to be found in Uganda. Zoonotic diseases such as Anthrax, leptospirosis, rabies, *Cysticercus bovis*, campylobacteriosis, *Bovine tuberculosis*, salmonellosis, and many others are among the diseases that are widespread throughout the country.

Infrastructure and human power

Delivery of animal health services have traditionally been considered as duty of the government. It was not until recently that most services became open for private practitioners (NAADS, 2011). For example, at present, private Agriculture Advisory Service Providers under NAADS share the load from state animal health services. The Food and Agricultural Organization of the United Nations (FAO) recommends one veterinarian for every 37,000 Veterinary Livestock Units. With the current status, the ratio of animal health professionals to livestock units in Buliisa District as shown in the table following below falls short of the FAO recommendation by about two fold.

Animal health service delivery infrastructure in Buliisa District

Type of infrastructure	Existing by July 2007	
	Public	Private
Animal Clinic	0	02
Animal health post	07	31
Regional laboratory	0	01
Research and referral centre	0	02
Vaccine production centre	0	0
National Tsetse and Trypanosomosis Investigation Centre (NTTIC)	1	0
Drug, equipment and vaccine importer	0	01
Drug shops	0	10
Clinics & drug shop	0	04

Source: Office of the District Veterinary Office –Buliisa District.

Organizational Setup and Activities of Veterinary Services

Animal health services are organized at national and district levels, each acting independently and in cooperation. The main functions of the National Animal Health Department are formulation of polices and strategies, collect and collate animal health information and distribute to those who need it, coordinate disease surveys and outbreak investigation, formulate projects to collect baseline data and disease control, participate in the control of transboundary diseases, enforce animal health regulations, issue certificate for export purposes, prepare work plan and budget for its activities, and provide technical inputs to the regional governments.

The functions of the District Animal Health Services Section are: provide preventive measures such as vaccination and clinical services, conduct annual vaccinations, collect data and report to the Department of Production and Marketing, infrastructure development, training animal health technicians and Community Animals Health Workers (CAHW), diagnostic activities, procurement of veterinary drugs from licensed dealers, licensing private practices, laboratory activities and control, veterinary public health activities including meat and other animal foods inspection. The National and local governments undertake disease control activities on all major infectious livestock diseases.

Drugs and Vaccine Control

The Ministry of Agriculture used to import and distribute bulk veterinary drugs and equipment and regulate importation by private importers. With the liberalization of the economy during the last ten years, however, livestock drugs and equipment are mainly imported by private companies. The control and administration of drugs was also transferred

to the National Drug Authority (NDA), licensing and control is no more a duty of the Ministry of Agriculture or regional governments. According to the information obtained from private practitioners, public veterinarians and personnel from the Ministry of Agriculture, drugs including antibiotics and trypanocidal drugs for treatment and control of animal diseases have become ordinary commodities. Examples of these are presented in Table 4.1 chapter of this manual, where issues on animal health are discussed in detail.

There is a growing concern that microorganisms may develop resistance to most available veterinary drugs unless control mechanisms are enforced. Livestock owners, the majority of whom do not have formal education, largely administer most antiprotozoal and anthelmintic drugs. While purchasing drugs from the open market, the size of the bolus or its attractive colour or the presence of pictures of healthy animals is the main criteria for the purchase of the drugs. The concentration of the active ingredient is not given much attention. For example, the *Anthelminthic boli* that contain active ingredients sufficient for a small 20 kg sheep but as big as a bolus, can be used to treat an adult zebu animal. Two things are of major concern; (i) the poor farmer does not treat animals and (ii) the microorganism might develop resistance to similar or the same drug.

Based on the above situation, standards should be set for veterinary drug importers. In addition, not all drugs should be left free for abuse. A standard in this aspect should be set to regulate drug use and users.

Constraints to provision of veterinary services

Lack of professionals and finance has been major shortcomings mentioned by both national and local animal health services. Organizational structure, which hinders conducting independent activities, has recently been sorted out and the Department of Animal Health Services is now restructured and acquired a Department status. Books on veterinary drugs and diseases of livestock, pets, fish, honey bees and other animals are not available in the bookshops and this is a major shortcoming that needs to be addressed.