



RESEARCH
PROGRAM ON
Roots, Tubers
and Bananas



Sweetpotato Silage Manual for Smallholder Farmers

*Expanding Utilization of Roots, Tubers and Bananas
and Reducing Their Postharvest Losses*

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The CGIAR Research Program on Roots, Tubers and Bananas (RTB) is a broad alliance led by the International Potato Center (CIP) jointly with Bioversity International, the International Center for Tropical Agriculture (CIAT), the International Institute for Tropical Agriculture (IITA), and CIRAD in collaboration with research and development partners. Our shared purpose is to tap the underutilized potential of root, tuber and banana crops for improving nutrition and food security, increasing incomes and fostering greater gender equity, especially among the world's poorest and most vulnerable populations.

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LIST OF ACRONYMS

CIAT	International Center for Tropical Agriculture
CIP	International Potato Center
GHG	Greenhouse Gas
IFAD	International Fund for Agricultural Development
IITA	International Institute for Tropical Agriculture
ILRI	International Livestock Research Institute
NaLIRRI	National Livestock Resources Research Institute
NARO	National Agricultural Research Organization
OFSP	Orange Fleshed Sweetpotato
RTB	CGIAR Research Program on Roots, Tubers and Bananas
Ug.shs	Ugandan Shillings
SPS	Sweetpotato silage

1. Introduction

This sweetpotato silage manual is made to benefit farmers and business entrepreneurs that would want to engage in sweetpotato silage making, marketing and use. It is based on practical experiences that were gained from studies and experiments conducted in Uganda by the International Potato Centre (CIP) and the International Livestock Research Institute (ILRI) in collaboration with other partners between 2014 and 2016. The manual focused on the piggery enterprise and covers five key aspects:

- Importance of sweetpotato in small-scale farming systems
- Sweetpotato establishment and management
- Pig production in Uganda
- Sweetpotato as a feed resource for pigs
- Sweetpotato silage production.

It is expected that the manual will give the reader incites for sweetpotato production and making sweetpotato silage to address feeding constraints.

1.1 Importance of sweetpotato in small-scale farming systems in Uganda

Sweetpotato is considered a priority crop and its importance in Uganda has increased significantly over the years. It is the third most important food crop after cassava and bananas in the country. In Africa, Uganda is the leading producer of sweetpotato (about 2.2 million tons/year) and second only to China in the world. Increased production has been driven more by expanded area under cultivation than from higher yields, which over the past decade have remained consistent at a national average of approximately 4.5 t ha⁻¹.

Women, generally play a dominant role in the production and utilization of sweetpotato in Uganda, from cultivation (vine selection, planting, weeding, and harvesting) through processing (washing, peeling, slicing and drying) to food preparation (cooking). Men are typically more involved in land preparation, transportation and sale of sweetpotato roots.

Sweetpotato offers several benefits to poor farming households and urban consumers:

(a) Life-saving nutrition

Sweetpotato roots are a good source of carbohydrates, calcium, ascorbic acid (vitamin C). Sweetpotato provides more edible energy per hectare per day than wheat, rice, or cassava. Its ability to produce good root yields under marginal environments, short production cycle and limited labour requirements makes sweetpotato to be particularly suitable for food insecure and micronutrient deficient households as well as those threatened by civil unrest, migration, or diseases such as HIV/AIDS.

The Orange Fleshed Sweetpotato (OFSP) varieties have been developed to address vitamin A deficiency. These varieties contain particularly high levels of carotenoids and are equalled only by carrot as a source of pro-vitamin A. If consumed, OFSP can reduce the risk of vitamin A deficiency: just one ice-cream scoop of OFSP (150 g) meets a child's full daily body requirement for vitamin A. Vitamin A deficiency is a major risk factor for children, pregnant and lactating women. It is one of the most serious health and nutrition problems in Uganda with approximately 50% of the children of Uganda affected. Symptoms including visual impairment, as well as greater susceptibility to deadly diseases such as measles, malaria, and diarrhoea.

The fresh leaves can be an important source of crude protein, vitamins A, C and B (riboflavin) and minerals.

(b) Food security

Sweetpotato is an important staple food crop for subsistence and small-scale farmers in Uganda. Sweetpotato roots have saved millions of people in Uganda from starvation when other crops were unavailable during prolonged dry seasons because it is drought tolerant. Sweetpotato roots may be eaten boiled, steamed or processed into simple products such as chips, bread, local brew/drink, juice, pancakes and composite flour (mixed with maize, millet and soya flour).

(c) Income generation

Sale of sweetpotato roots, vines and their products contribute to household income. Sweetpotato vines are sold as a source of planting materials while the same vines can be sold as feed for livestock. Sweetpotato roots may be processed into simple products such as chips, bread, local brew/drink, juice, pancakes and composite flour (mixed with maize, millet and soya flour). Sweetpotato is used in industrial processes to produce alcohol and starch.



Some of the products from sweetpotato

(d) Source of livestock feed

A large amount of sweetpotato harvest is comprised of vines, non-marketable roots and peels. Part of vines are used as planting material, fed to livestock in fresh form and some of the non-marketable roots are used for household consumption. Nevertheless, a large amount of these by-products are wasted due to their high perishability. However, all these are potential livestock feed resources. Sweetpotato vines have a high crude protein (19-22%). They can therefore provide high quality feed for pigs, cattle, sheep, poultry and goats. Farmers feeding sweetpotato vines to their chicken, report that they produce more and better quality eggs. Studies show that dairy cows fed with high-protein sweetpotato vines produce less methane gas than when fed on other feed, potentially helping reduce harmful Green House Gases (GHG) global emissions. Silage made from sweetpotato vines and non-commercial roots provide an excellent low cost feed for pigs, cattle, goats and sheep. Feeding sweetpotato roots to pigs offers a good opportunity to convert an undesirable and often unmarketable crop into a high-value commodity - pork. Sweetpotato residues can also be dried, ground and mixed with molasses to make pellets for livestock. Studies conducted at the National Livestock Resources Research Institute (NaLIRRI) have shown that sweetpotato vine-based partial milk diets can be used as substitutes to reduce the cost of rearing a calf without adversely affecting its health and yet save more milk for sale and processing.

1.2 Characteristics of important sweetpotato varieties

Because of the important role sweetpotato plays in the nutrition, food and income security, the Government of Uganda, through the National Agricultural Research Organization (NARO) and the International Potato Centre (CIP) has given high priority to research on this crop. Many sweetpotato varieties (orange fleshed and non-orange fleshed) have been

released in Uganda. White- and yellow- fleshed sweetpotato varieties, unlike OFSP, have little or no beta-carotene content (the precursor for vitamin A). Table 1 shows key characteristics of some of the released sweetpotato varieties.

Table 1: Characteristics of some of the released sweetpotato varieties

Sweetpotato Variety	Average root yield (t ha ⁻¹)		Fresh colour	Tolerance levels to pests and diseases		
	On-station	On-farm		Weevil (Cylas spp.)	Sweetpotato virus disease	Alternaria blight
Bwanjule	21	17	White	Moderate	Resistant	Resistant
New Kawogo	23	17	White	Moderate	Resistant	Susceptible
Wagabolige	24	16	White	Moderate	Resistant	High susceptible
Tanzania	23	21	Pale yellow	Susceptible	Moderate	Moderate
NASPOT 1	29	20	Pale yellow	Susceptible	Moderate	Susceptible
NASPOT 2	21	18	Cream	Susceptible	Resistant	Susceptible
NASPOT 3	25	17	Cream	Moderate	Resistant	Resistant
NASPOT 4	21	18	Pale yellow	Moderate	Moderate	Resistant
NASPOT 5	23	16	Orange	Moderate	Moderate	Resistant
NASPOT 6	24	18	White	Moderate	Moderate	Resistant
Ejumula	19	15	Orange	Susceptible	Susceptible	Moderate
Kakamega	15	12	Pale orange	Susceptible	Moderate	Moderate
NASPOT 7	25	12	Pale orange	Susceptible	Moderate	Moderate
NASPOT 8	20	16	Pale orange	Susceptible	Moderate	Moderate
NASPOT 9	20	13	Orange	Susceptible	Moderate	Moderate
NASPOT 10	18	12	Orange	Susceptible	Moderate	Moderate
Dimbuka Bukulula	30	16	Cream	Susceptible	Susceptible	Moderate
NASPOT 11	38	20	Cream	Susceptible	Moderate	Resistant
NASPOT 12	46.1	16.2	Orange	Moderate	Moderate	Resistant
NASPOT 13	27.8	10.2	Orange	Moderate	Moderate	Resistant

Source: Sweetpotato Program, NaCRRI

Some sweetpotato varieties are suitable for dual purpose uses, i.e. they produce good volumes of vines without compromising root yield, thus meeting livestock and human food needs. These are the varieties that are suitable for the silage technology in the Ugandan setting. Table 2 shows average root/vine yield ratio of four common sweetpotato varieties. It should be noted that a root/vine ratio between 1 and 2 indicates the variety's suitability for dual purpose use (above 2 is primarily for root production). NASPOT 11 variety, is therefore most suitable for dual-purpose use. Furthermore, NASPOT 11 was also less affected by detopping, i.e. partial vine harvesting at 85 days after planting (Table 3).

Table 2: Average root/vine yield ratio of four common sweetpotato varieties

Sweetpotato variety	Root /Vine Ratio	Comment
Local	0.8	Forage
NASPOT 11	1.7	High dual purpose
NASPOT 12	1.2	Low dual purpose
NASPOT 13	1.1	Low dual purpose

Table 3: Average root and vine yield of four sweetpotato varieties
under different vine harvesting regimes

Sweetpotato variety	Treatment*	Root yield	Vine yield
		(t ha ⁻¹)	(t ha ⁻¹)
Local	D	4.6	20.2
	ND	9.9	21.1
NASPOT 11	D	10	21.4
	ND	10	24.4
NASPOT 12	D	8.9	21.6
	ND	9.4	22.3
NASPOT 13	D	7.6	19.4
	ND	9.2	21.4
Mean		8.7	21.5

Source: (Akiror and Kyalo, 2016)

*D= Detopped ND= Non detopped

2. Sweetpotato establishment and management

2.1 Soil and climate

High yields of good quality sweetpotatoes depend on many factors which include: soil type, climate, sweetpotato varieties, planting methods, pests and diseases levels. Sandy loam soils with a pH range of 5.5-7.0 generally produce better yields than heavy-textured soils. The site should be at least 50 m away from old sweetpotato crop to minimize spread of pests and diseases from old to new crop. A well distributed rainfall of 750–1000 mm per year is considered most suitable for the crop.

2.2 Establishment

Deep cultivation (at least 15 cm) improves the oxygen supply in the soil, thus favouring the growth of bacteria that help in decomposing organic matter. Sweetpotato is grown from vines which are normally cut from a sweetpotato garden or sprouts from old sweetpotato gardens. Planting material should be selected from healthy and vigorous fields (2-3 months old), vines from old fields produce a less vigorous crop and contribute to poor yield. Sweetpotato is either planted on mounds or on ridges. A mound should be 100 cm wide and 60 cm high, the distance between mounds should be 1 m. Ridges are spaced at 0.5 m from each other. Organic fertilizers (composted manure, poultry and green manure) release nutrients slowly and therefore should be applied as a basal fertilizer (incorporated when making mounds or ridges).



Planting on ridges



Planting on mounds

2.3 Management and control of pests and diseases

The field should be kept free from weeds. After about two months, the canopy of the crop is normally big enough, covering the ground and this helps to keep weeds away. Pests and viral diseases cause yield reductions, potentially from 50 to 70 percent. The major pests are: sweetpotato weevils (*Cylas* spp.) which feed on the epidermis of vines and leaves and sweetpotato hornworm which feed on the leaf blades, causing irregular holes, and may eat the entire blade, leaving only the petiole.



Larval stage of Sweetpotato weevils



Sweetpotato hornworm

Several viral diseases such as black rot; ring rot disease; fusarium root and stem rot are significant constraints to sweetpotato in Uganda.



Black rot disease



Ring rot Fusarium root and stem rot

Cultural control practices have proved to be effective against sweetpotato pests and diseases and should be the main basis of control. These include:

- a) use of clean planting material, especially vine tips;
- b) crop rotation;
- c) removal of volunteer plants and crop debris (sanitation);
- d) timely planting and prompt harvesting to avoid a dry period;
- e) planting away from weevil-infested fields;
- f) hilling-up of soil around the base of plants and filling in of soil cracks and;
- g) Applying sufficient irrigation to prevent or reduce soil cracking.

2.4 Harvesting, consumption, storage and marketing

Sweetpotatoes mature between 4-7 months after planting, depending on the variety and location (altitude). Usually, sweetpotatoes are ready to harvest when the leaves and ends of the vines have started turning to yellow. Harvesting the roots in piecemeal (removing big roots and creating room for small ones) can start at 3 to 4 months. Complete or total harvesting takes place when the crop is mature.

Sweetpotato is generally consumed in fresh form. But in places with high infestation rates of weevils, roots cannot be left in the soil or field for long. Here, mature roots are normally harvested, chipped, and sun-dried to make products such as *inginyo* and *amukek* (Iteso). Sweetpotatoes can be baked, roasted and processed into dry chips, pounded into powder to make other delicacies like cakes, cookies, pancakes, etc. Sweetpotato roots can also be stored for several months using various storage methods.

Sweetpotato roots are frequently damaged during storage mainly by storage weevils and vermin (rats, moles and domestic and wild animals). The most important control measures to reduce the damage is the re-drying of the traditionally processed sweetpotato products and the use of biological control methods and natural pesticides (for example the Neem tree leaves and chilli) to control storage weevils and vermin.

3. Pig production in Uganda

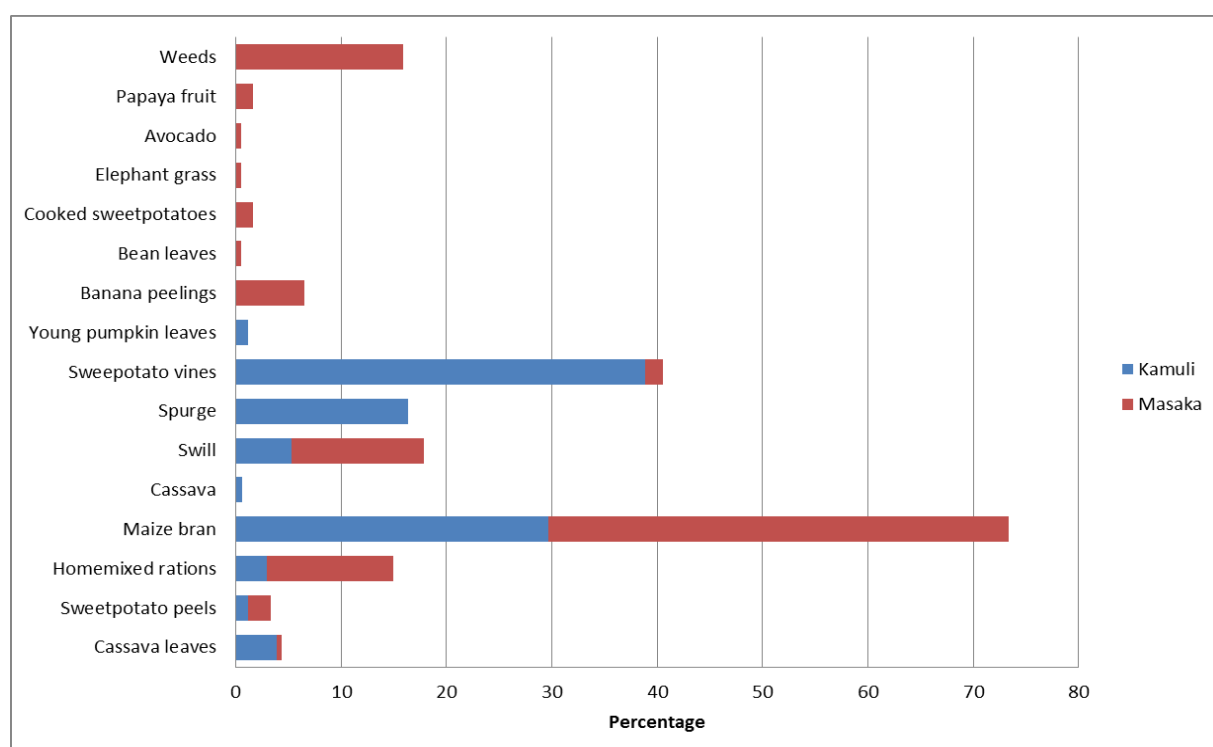
3.1 Importance of pig production

Pig production has increasingly become an important activity, especially among small-scale farmers as evidenced by a dramatic rise in pig population from 0.19 million in 1980 to 1.7 million in 2002 and 3.2 million in 2008. About 1.1 million households keep pigs. Per capita annual consumption of pork in Uganda is 3.5 kilograms, making Uganda the largest consumer of pork in Africa. However, while the pigs sub-sector is growing by leaps and bounds, it is facing several challenges including poor quality and quantity of local feeds and high cost of commercial feeds.

3.2 Major feed resources for pigs

A variety of feeds are available to pig producers, ranging from commercial concentrates, agro-industrial by products, restaurant leftovers, home-grown and wild forages (Figure 1). However, their utilization by farmers is largely dependent on cost, availability and knowledge

on how to properly utilize them. Figure 1 below, shows how important sweetpotato vines are in pig production systems in Kamuli and Masaka districts. In addition, sweetpotato vines and other products have high levels of crude protein and dry matter (Table 4).



Source: Lukuyu and Lule (2016)

Figure 1: Local pig feed resources in Masaka and Kamuli districts

Table 4: Nutritional content of the common feed types in Uganda

Feed type	%Dry matter	%Crude protein	Digestible energy (Kcal kg^{-1})
Cassava leaves	22.9	22.9	2709
Sweetpotato peels	26.39	6.21	3489
Home mixed rations	13.07	24.5	2128
Maize bran	84.7	13	2690
Swill	12.5	5.5	2906
Spurge	15.2	25.1	2738
Sweetpotato vines	15.9	14.9	2024
Young pumpkin leaves	14	18	0
Banana peelings	13.07	24	2128
Bean leaves	88	7.1	3759
Cooked sweetpotatoes	26.39	6.21	3489
Elephant grass	18.8	17.1	535
Avocado	18.37	6.52	3326
Papaya fruit	8	10.8	3182
Weeds	17.3	23.4	1877

Source: Lukuyu and Lule (2016)

4. Sweetpotato as a feed resource for pigs

Sweetpotato residues (peels, vines and non-commercial roots) are a major feed resource for pigs in Uganda and are a cheap source of energy (roots) and protein (vines). Sweetpotato residues may be fed fresh, dried or ensiled. Proper conservation of sweetpotato residues can help address the scarcity of nutrient feeds during periods of scarcity in prolonged dry seasons.



Pigs feeding on fresh sweetpotato leaves and vines

4.1 Challenges in using sweetpotato residues as a feed resource

Sweetpotato residues are highly perishable. There are times after harvesting that farmers have a large amount of residues which are left in the fields. Yet the very same farmers often have pigs and other livestock which would feed on these vines and roots. Research conducted by CIP in Kamuli and Masaka districts identified how farmers use different components of sweetpotatoes (Table 5). Farmers waste an average of 24% and 22% of the vines and non-marketable roots, respectively.

Table 5: Utilization of sweetpotato components by farmers

Sweetpotato component	Usage (%)						
	Food	Planting material	Animal feed	Sell	Manure	Given to neighbors	Thrown away
Big roots	67.5	0.0	0.0	32.5	0.0	0.0	0.0
Small roots	72.6	0.0	21.3	3.0	0.0	0.1	3.0
Low quality roots	16.9	0.0	59.5	0.6	0.4	0.8	21.8
Peels	0.0	0.0	82.7	0.0	5.2	1.0	11.1
Vines	0.0	28.6	44.2	2.2	0.6	0.2	24.2

Source: Asindu (2016)

During times of scarcity, particularly in the dry season, farmers have little to feed the pigs and sometimes have to reduce their herd. Silage technology would allow to conserve sweetpotato residues for several months and therefore has the potential to mitigate seasonal feed shortages and assist in coping with seasonal feed prices fluctuations that many smallholder livestock farmers experience.

5. Sweetpotato silage production

Silage is fermented high moisture stored fodder to be fed to livestock. Forage which has been grown while still green and nutritious can be conserved through a natural 'pickling' process. Lactic acid is produced when the sugars in the forage plants are fermented by bacteria in a sealed airtight container ('silo'). Forage conserved this way is known as '**silage**' and will keep for up to three years without deteriorating.

5.1 Benefits from sweetpotato silage making technology

- (a) Limits wastage of valuable feed resources;
- (b) Ensures stable composition of the diet for a longer period;
- (c) Represents a convenient and inexpensive method of providing a range of nutrients required by the animal, which may be deficient in the diet;
- (d) Its protein content and digestibility makes it an excellent complement to grass feeds (Table 6);
- (e) Reduces methane gas which is responsible for global warming;
- (f) Provides a business opportunity for investment to unemployed youth who loathe agriculture as a direct employment option.

Table 6: Nutritive value of Sweetpotato vines, Napier grass, Sweetpotato vines-Napier mixture and silage

	DM	CP	ADF	NDF	EE
SPV	22.2	12.1	35.6	46.8	1.7
SPV silage	26.2	11.3	27.5	40.1	4.2
Napier	16.9	13.2	31.9	59.0	0.8
Napier silage	16.4	10.3	27.2	46.2	5.9
SPV-Napier	19.8	14.2	35.2	51.4	1.0
SPV-Napier silage	22.8	13.1	25.5	37.2	4.0

Source: Lutwama and Sentambi (2016) Napier was harvested at 7 weeks of age, SPV-Napier was mixed at a ratio of 1:1

5.2 Principle of silage making technology for smallholder farmers

Small-scale livestock farmers can store silage in various ways such as:

1. Polythene tube silos
2. Stack silo

Trench silo is another option but this is most suitable for larger scale production and therefore is not covered in this manual.

5.2.1 Polythene tube silo technology

Tube silage making technology is simple, cost effective and ideal for smallholder livestock farmers. Some innovative youths such as *Bavubuka Twekembe* group in Wakiso district have identified the technology as a business opportunity and, in addition to selling, are providing the service of making sweetpotato tube silage at a fee.

The major advantages of tube silage making technology are:

- Ensures a consistent supply of high quality animal feeds, leading to good returns from the enterprise;
- Limits wastage by conserving excess residues;
- It is easier to ration the silage at the time of feeding if it is in small batches of known quantity;
- It is affordable for small-scale farmers who make and use small quantities of silage at a time;
- It is environmentally friendly since it does not release effluent, and the sack can be re-used.

Materials required

Material requirements for the tube silo technology includes:-

- Sweetpotato residues
- Black polythene tubes, 2.5 m, gauge 600-800 mm,
- Maize bran
- Forage chopper or a machete
- Tarpaulin
- 100 kg sacks
- Weighing scale
- Medium sized bucket
- 5 L plastic container for mixing
- Watering can
- Sisal twine
- Water
- 4 laborers to produce 1,000 kg of silage.

Steps for silage preparation

The following steps should be followed very carefully to make quality silage.

1. Harvest or purchase sweetpotato residues.
2. Spread the residues for at least half a day to reduce the moisture content (wilting)
3. Chop the residues into to 2.5 cm length pieces using a forage chopper or a *panga* (*machete*).



A farmer chopping sweetpotato vines using a motorized forage chopper

4. Spread well chopped residues on the tarpaulin.



The chopped material is spread on the tarpaulin

5. To make 100 kg of silage (one tube) mix 5 kg of maize bran with 95 kg of chopped sweetpotato residues and mix thoroughly. Sweetpotato silage can also be made by mixing 1 L molasses with 3 L of water and sprinkle the mixture over the material. However, **maize bran produces better silage because it reduces the quantity of effluent from the silage.** If non-marketable sweetpotato roots are available, a ratio of 75 kg of vines, 20 kg of non-marketable roots and 5 kg of maize bran can be used.



Mixing chopped sweetpotato residues with maize bran

6. Pleat the black polythene tube (about 1.5 m long, gauge of 600-800 mm) lengthwise, tie firmly with the sisal twine at 30cm distance from the cut edge, fold back the edge and tie once again to exclude the air.
7. Turn the polythene bag inside out.
8. Roll down or fold back the top of the polythene tube and place the tube into another synthetic sack used for packing sugar, salt, rice and maize flour. The sack protects the polythene tube from being damaged by rodents and hot weather.
9. Put the material in the polythene tube. You can also use plastic drums to make silage.



Tie the silage tube firmly with the sisal twine



A polythene tube is placed into a synthetic sac to protect the tube from being damaged



Plastic drums can be used for silage production

10. Compress the mixture firmly to exclude all the air. You can stand inside the bag and compress the mixture down thoroughly using the feet.



You can stand inside the bag and compress the mixture down thoroughly using the feet

11. Repeat the steps until the polythene tube is full.
12. Add the mixture to the polythene tube in small quantities and compress until it is full.
13. Hold the top of the polythene bag firmly excluding the air. Tie the bag firmly with a sisal twine excluding the air to encourage the growth of fermentation bacteria.



A farmer ties the polythene tube containing silage

14. Place a weight at the top to exclude the air which if allowed will make the mixture to rot due to activity of rotting bacteria.

15. Sweetpotato tube silage should be stored under a shade, for example in a store or under a shelter. Rodents like rats that could tear the tube need to be controlled.



A simple structure for storing silage

Cost of materials

Below (Table 7) are some of the estimated costs for production of 500 kg of silage. The cost can go down if one does not hire a forage chopper and uses a panga (machete). Also the cost of the tarpaulin is a one off payment since it can be used several times.

Table 7: Estimated cost of producing 500kgs of sweetpotato silage

Material	Quantity	Rate (UGX)	Total amount (UGX)*
Sweetpotato vines from own field (kgs) - includes transport and labor	475	50	23,750
Hiring a forage chopper - includes fuel	1	30,000	30,000
Polythene material for 10 tube silos	10	4,000	40,000
Tarpaulin	1	30,000	30,000
Labor for ensiling process	2	20,000	40,000
Sisal string (rolls)	0.5	5,000	2,500
Maize bran	25	500	13,750
Total			180,000
Cost per kg of silage (UGX)			360

5.2.2 Stack silo technology

The steps are very similar to the ones described for the tube silo. A plastic sheet (about 0.1 mm thick) is spread over the ground. The material (sweetpotato residues) for making silage

is chopped using a forage chopper or a panga and placed on the sheet or cemented floor. The material is entirely covered with a plastic sheet. Proper tread pressure should be applied, and complete sealing is required. The size of a silo depends on the number of animals.



Stack silo

Important note on stack silo

- The size of a silo can vary. However, stack silo is more suitable for larger pig farms or if large volume of sales is ensured.
- It is necessary to make steps to prevent damages on the plastic sheet by field mice or birds.
- Once exposed to air the silage degrades very quickly. Therefore, if sold, buyers will also need to consume it quickly and come back frequently (so either large pig farmers or likely repeatedly purchase small amounts each time).

5.3 Sweetpotato silage utilization

- Wait for 21 to 30 days until the fermentation process is complete before use.
- Well-prepared sweetpotato silage is bright or light yellow-green in color, has a strong sweet smell like that of fermented milk and has a firm texture. Poor quality silage tends to smell like rancid butter or ammonia.
- The amount of silage to be fed per animal will depend on the age and weight of the animal. In general, silage should be used not in excess of 5 kg for pigs.
- Silage is best fed to pigs that are 3 months or older and weigh more than 25 kg.
- After feeding, the feed troughs must be cleaned to ensure that any remaining silage is removed as it will spoil and contaminate the next feed.
- When feeding, open the tube and after removing the amount needed, remember to re-tie without trapping air inside.

Feeding pigs on sweetpotato silage alone does not support optimum levels of weight gain of pigs. Research conducted by the RTB-ENDURE team provided evidence that **sweetpotato vine silage should be ideally supplemented at a level of 40% with a pig concentrate** (Table 8) in order to improve pig growth performance (Table 9).

Table 8: Composition and cost of concentrate diet for pigs (100 kg)

Ingredient	%	Unit cost (UGX)	Total cost (UGX)
Maize bran	75.7	550	41,635
Soybean	21	2,000	42,000
Dical- Phosphate	2	1,200	2,400
Lysine	0.3	9,000	2,700
Vit- min premix	0.5	500	250
Salt	0.5	1,000	500
Total	100		89,485

Source: Mutetikka et al. (2016)

Table 9: Means of daily gain, feed intake and feed/gain

Parameter	Control	Silage (60%) + Supplement (40%)	Standard Error of the Mean (SEM)
Initial weight (kg)	11.61	11.49	0.27
Final weight (kg)	29.36	32.29	1.50
Daily feed intake (kg)	1.45	1.21	0.04
Average daily gain (kg)	0.18	0.23	0.02
Feed/Gain	4.59	4.16	0.17

Source: Mutetikka et al. (2016)

5.4 Additional guidelines for feeding sweetpotato silage to pigs

Key notes

- A pig consumes approximately 3-6% of its body weight per day.
- Weigh the pig weekly to know how much feed to provide.
- Silage is best fed to pigs that are 3 months or older and weigh more than 25 kg.
- SPS should be supplemented with an ideal feed.
- Supplementation involves replacing a portion of the silage with an ideal feed diet to provide nutrients not supplied by the silage in enough quantities.
- The silage is the main (basal) feed and the ideal feed is the supplement.
- Sweet Potato Silage (SPS) should constitute 60% of the daily ration with 40% provided by the supplement.
- Weigh out and feed the supplement first, then give the pigs as much SPS as they can consume (ad lib.)
- Provide clean fresh water to the pigs all the time.

Feeding guide

Pig Body Weight (kg)	Amount of supplement (g /day)	Amount of SPV silage
20	480	ad lib
40	680	ad lib
60	800	ad lib
80	920	ad lib
100	1000	ad lib

Supplement composition (Ideal feed)

Ingredients	Composition (%)
Maize bran	76
Soybean	20.7
Shells	2
Lysine	0.3
Vitamin mineral premix	0.5
Salt	0.5

Daily feed allowance for a 20kg pig on an ideal feed ration (no silage)



=



800g

Daily Feed allowance for a 20kg pig fed on sweetpotato silage + supplement



=



480g

+



SPS



= Quantity of ideal feed supplement

SPS = Sweetpotato silage fed free choice

6. Acknowledgements

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