



RESEARCH PROGRAM ON
Roots, Tubers
and Bananas



Training report: Training of Trainers and Farmers' Training on Validated Sweetpotato Silage Making and Use in Masaka and Kamuli Districts

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



December 2016



Prepared by:

Jolly M.L. Kabirizi¹; Peter Lule², Vincent Lutwama³, John Kigongo ¹, and Dan Isabirye³

¹ National Livestock Resources Research Institute (NaLIRRI)

² International Livestock Research Institute (ILRI)

³ Bavubuka Tweekembe Group, Uganda

A broad alliance of
research-for-development
stakeholders & partners



www.rtb.cgiar.org



RTB-ENDURE is a 3 year project (2014-2016) implemented by the CGIAR Research Program on Roots, Tubers and Bananas (RTB) with funding by the European Union and technical support of IFAD.

<http://www.rtb.cgiar.org/endure>

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.



Table of Contents

I. Introduction	3
II. Sweetpotato for food and feed security.....	3
III. Challenges to utilisation of sweetpotato residues as animal feed	4
IV. Structure of the workshop and participants	4
V. TOTs workshops in Masaka and Kamuli districts.....	6
1. Participants' (TOTs) expectations.....	7
2. Presentations by Dr. Jolly Kabirizi, NaLIRRI	8
3. Presentation by ILRI representative (Peter Lule Mulindwa).....	17
4. Comments/questions from TOTs in Masaka and Kamuli districts	17
5. Practical on silage making (TOTs).....	19
VI. Farmers training workshops in Masaka and Kamuli districts	22
1. Expectations.....	23
2. Presentations	24
3. Questions/discussion (farmers in Bugulumbya and Butansi sub-counties).....	24
4. Practical session on silage making in Masaka and Kamuli districts	27
VII. Workshop evaluation.....	29
ANNEXES	30
Annex 1. Workshop Program.....	30
Annex 2. List of participants.....	31
1. Masaka District.....	31
2. Kamuli District.....	33



List of Acronyms

CIAT	International Center for Tropical Agriculture
CIP	International Potato Center
IFAD	International Fund for Agricultural Development
IITA	International Institute for Tropical Agriculture
ILRI	International Livestock Research Institute
NALIRRI	National Livestock Resources Research Institute, Uganda
NARO	National Agricultural Research Organization, Uganda
OFSP	Orange Fleshed Sweetpotato
RTB	CGIAR Research Program on Roots, Tubers and Bananas
SP	Sweetpotato
SPV	Sweetpotato vines
ToT	Training of Trainers
UGX	Uganda shillings
ZARDI	Zonal Agricultural Research and Development Institute



I. Introduction

The 'Expanding Utilization of Roots, Tubers and Banana and Reducing Their Postharvest Losses' (RTB-ENDURE) is a three-year project that is being implemented in Uganda. The goal is to contribute to improved food security and incomes for RTB-producing communities in East Africa, including producers and other stakeholders along the value chain. This initiative addresses postharvest management of RTB crops and explores potentials for expanding the utilization of potato, sweetpotato, banana and cassava, and repositioning them as added value crops.

Four research sub-projects are operational: (i) ambient storage and improved agronomic practices in a bid to reduce postharvest losses and extend the marketing period for ware potato; (ii) agronomic practices, waxing and relative humidity storage for fresh cassava roots to extend shelf-life and capture emerging markets opportunities; (iii) sweetpotato silage to mitigate animal feed constraints faced by smallholder pig farmers; and (iv) promotion of cooking banana varieties with intrinsic longer shelf life, sucker staggering and storage to even out market supply and promote product differentiation.

In order to achieve the sweetpotato sub-project's key objectives, it was deemed necessary to build the capacities of sweetpotato and pig farmers to process sweetpotato residues into silage to be fed to pigs primarily in the dry season when pig farmers face serious challenges to access quality and affordable feedstuff.

It is against this background that NALIRRI, in collaboration with the International Livestock Research Institute (ILRI), the Bavubuka Tweekembe Group, the International Potato Center (CIP), CHAIN-Uganda, VEDCO and the Kamenyamiggo Zonal Agricultural and Development Research Institute (ZARDI) has held a series of training workshops to strengthen the technical capacities of selected stakeholders in the two target districts, namely Masaka (Nyendo Senyange and Buwunga) and Kamuli (Butansi and Bugulumbya sub-counties). The major objective of the workshops was to equip participants with knowledge of sweetpotato silage making and utilization. Training of Trainers (TOT) and farmers' trainings on silage making were already conducted between August and October 2015. However, these additional trainings were deemed necessary in order to i) strengthen participants' capacities in utilizing sweetpotato silage; ii) impart content that has been validated and/or fine-tuned and/or adapted based on the most recent findings from the research undertaken by the sweetpotato sub-project's team over the previous two years; iii) target additional participants.

II. Sweetpotato for food and feed security

Sweetpotato is the third most important food crop after cassava and bananas in Uganda. Currently, sweetpotato is the major food crop in the Lake Victoria region. The crop has potentials to benefit poor rural households and urban consumers especially when other crops fail or in specific seasons before the main harvest.

Sweetpotato is a means to address one of the most serious health and nutrition problems of Uganda, Vitamin A deficiency which is a major risk factor for pregnant and lactating women. The Orange Fleshed Sweetpotato (OFSP) cultivars contain particularly high levels of carotenoids and are equalled only by carrot as a source of pro-vitamin A. Sweetpotato roots provide a source of carbohydrates, calcium, ascorbic acid (vitamin C). 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). In some communities, tender (young) sweetpotato leaves are consumed as a vegetable. Sweetpotato contributes about 20% of total crop residues provided by vines, non-commercial sweetpotato roots, peels which are very good source of livestock feed



III. Challenges to utilisation of sweetpotato residues as animal feed

Although sweet potatoes are a good source of energy (roots) and protein (vines), they are highly perishable. As a result, substantial amounts of vines are wasted during periods of peak harvests, yet farmers suffer from feed scarcity during the dry season. In order to make good use of sweetpotato residues (vines and roots) there is need to conserve them in form of silage which has the potential to mitigate seasonal feed shortages and help cope with seasonal feed prices fluctuations that many smallholder livestock farmers experience. It also provides opportunity to reduce waste in urban market and at household level as well as it can open up business opportunities for youth and women.

IV. Structure of the workshop and participants

Masaka district

The ToT workshop was conducted at Kamenyamiggo-ZARDI on 29th November 2016. The farmer workshops were conducted at St. Paul Primary School, Kitovu, Senyange sub-county on 30th November 2016 and at Buwunga Sub-county headquarters, Buwunga sub-county on 1st December 2016. The workshop was organized by the International Potato Centre (CIP), International Livestock Research Institute (ILRI), and National Livestock Resources Research Institute (NALIRRI), Bavubuka Twekembe group, CHAIN UGANDA and Masaka local government.



Participants to the TOT workshop at Kamenyamiggo-ZARDI

Kamuli district

The ToT workshop was conducted at VEDCO premises on 13th December 2016. The farmer workshops were conducted at Kiwungu Baptist Church, Butansi sub-county and at Bukyonza

Primary School, Bukyonza village, Bugulumbya sub-county on 14th and 15th December 2016, respectively. The workshops were organized and conducted by the International Potato Centre (CIP), VEDCO, International Livestock Research Institute (ILRI), National Livestock Resources Research Institute (NaLIRRI), Bavubuka Tweekembe group.



Participants to the TOT workshop at VEDCO offices, Kamuli

Facilitators

The facilitators of the workshop were; Dr. Jolly Kabirizi (NaLIRRI), Dr. Peter Lule (ILRI), Mr. Kizito (VEDCO), Mr. Vincent Lutwama and Mr. Dan Isabirye (Bavubuka Tweekembe Group) and Mr. John Kigongo (NaLIRRI). A total of **287** participants (150 female) attended the workshops in Masaka and Kamuli districts (Table 1 and Annex 1).



Table 1: Workshop participants by gender

Venue	Male	Female	Total
Masaka district			
Kamenyamiggo ZARDI (Training of Trainers)	11	5	14
Nyendo Ssenyange sub-county (Farmers)	11	33	54
Buwunga sub-county (Farmers)	27	28	55
Kamuli district			
VEDCO (Training of Trainers)	16	8	24
Butansi sub-county (Farmers)	37	33	70
Bugulumba sub-county (Farmers)	27	43	70
TOTAL	129	150	287

V. TOTs workshops in Masaka and Kamuli districts

The participants started with a prayer after which each participant introduced him/herself (name, institution/district and experience on sweetpotato as a food and animal feed). All participants reported that they had experience with working with sweetpotatoes but five extension staff from Masaka district reported that they had no information on sweetpotato silage production and that they were very happy to attend the workshop.



Official opening in Masaka district by Dr. Mayega



1. Participants' (TOTs) expectations

Participants were requested to indicate at least two expectations from the workshop. Below is a summary of TOTs expectations.

(i) Masaka district

- Facilitation to demonstrate silage making
- Silage making with different materials
- Making of nutrient feed blocks
- How to acquire forage machines at subsidized price but of good quality
- Get information on opportunities for silage making as a business
- Knowledge on sweetpotato silage production
- Qualities to be fed to different types of livestock.
- Learn methods of silage making
- Costs involved in silage making
- Whether winter feeding silage to pigs can maintain pig growth without supplementation
- What is needed when making silage
- How long can sweetpotato silage last after opening the silo
- Alternative materials we can use to make silage
- How valuable is silage to the farmers
- Good method/procedure of making silage
- Know the composition of feed rations for dairy cattle and pigs

(ii) Kamuli district

- View a silage silo
- Which variety of sweetpotato is best for silage
- Reasons for silage making for pig production
- Practical skills for silage making
- Learning how to make silage
- Knowledge to reduce on feeding costs of pigs, while achieving good quality pigs.
- How to feed the silage to the different animals
- Procedure of making silage
- Cost benefit analysis of use of sweetpotato vines as a feed to the different animals
- How silage is got/made from sweet potatoes
- What animals to feed on sweetpotato silage
- To see sweetpotato silage made in Seguku
- To know the nutritive value/components in sweetpotato silage
- What sweetpotato variety is good for silage making
- Shelf life of the silage
- To learn how to grow potatoes for silage
- To become specialists in silage making
- To know the proper use of potato vines for silage
- The marketing strategy if they take it up



Presentations

2. Presentations by Dr. Jolly Kabirizi, NaLIRRI

Dr. Jolly Kabirizi made a PowerPoint presentation highlighting findings from RTB-ENDURE project. Below are highlights of her presentation:

Presentation outline

- Role of pigs in smallholder production systems
- Challenges to pig production in Uganda
- Major feed resources in smallholder pig production systems in Uganda
- Benefits from sweetpotato (SP) crop in Uganda
- SP residues as livestock feeds
- Challenges to the use of SP residues
- SP silage for improved pig production
- SP silage tube making technology for smallholder farmers

Role of pigs in smallholder systems

- Pig population has increased from 0.19 m in 1980 to 3.2 m in 2008 (UBOS, 2012).
- Food and nutrition security----of the total per capita meat consumption of 10–11 kg in Uganda, 3.4 kg are of pork.
- Risk diversification & livelihood security of poor households----important asset useful in generating income
- Source of manure
- Source of income from the sale of piglets & live adult pigs -----a source of wealth.

Challenges in small-scale pig production systems

- Poor marketing systems
- Pests and diseases
- Limited capital for investment
- Poor breeds
- Limited value addition
- Seasonal variation in feed quality & quantity
- High cost of and/or poor quality inputs e.g. feeds
- Need to use affordable rations based on local ingredients

Major pig feed resources

- *Crop residues*: Sweetpotato residues (vines, peels & non-marketable roots) banana and cassava peels
- *Cultivated forages*: Planted forages such as Lablab, Mucuna, *Crotalaria spp* & Russian comfrey
- *Commercial & homemade concentrates*
- *Conserved forages*: Sweetpotato silage
- *Others*: Jackfruit & avocado leaves, weeds, amaranths

Figure 1 shows local feed resources used by farmers to feed pigs in Kamuli and Masaka districts. This was part of the RTB-ENDURE project findings presented during the end of project held from 6th to 7th December 2016, Imperial Golf View Hotel, Entebbe, Uganda.

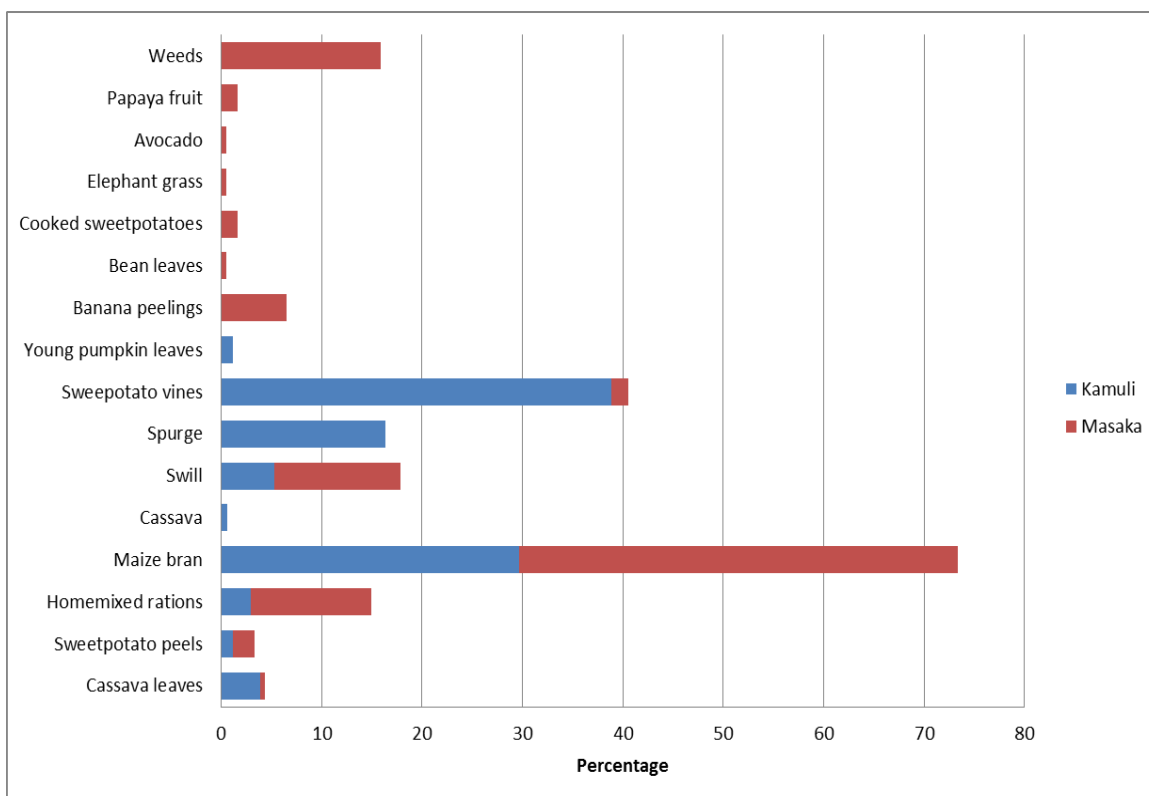


Figure 1: Local pig feed resources in Masaka and Kamuli districts

Table 2 shows nutritive value of common feed resources.

Table 2: Nutritive content of the common feed types fed to pigs in Uganda

Feed type	Dry matter (%)	Crude protein (%)
Cassava leaves	22.9	22.9
Sweetpotato peels	26.39	6.21
Home mixed rations	13.07	24.5
Maize bran	84.7	13
Sweetpotato vines	15.9	14.9
Young pumpkin leaves	14	18
Banana peelings	13.07	24
Bean leaves	88	7.1
Cooked sweet potatoes	26.39	6.21
Elephant grass	18.8	17.1
Avocado	18.37	6.52
Papaya fruit	8	10.8
Weeds	17.3	23.4



Sweetpotato production in Uganda

- Sweetpotato is the 3rd most important food crop after cassava and bananas in Uganda
- Uganda is a leading producer of SPs (about 2.2 million tons/year)
- Grown for food and feed security
- Fresh form can only be fed for a short period of time after harvest
- Preservation of vines in form of silage to extend shelf life

Categories of sweetpotato varieties

Tables 3 and 4 show selected sweetpotato varieties and their attributes.

Table 3: Some of the released sweetpotato varieties and their attribute

Variety	Year released	Root yield (t/ha)		Pest/disease resistance		
		Station	Farm	SPW	SPVD	Alternaria
Ejumula	2004	19	15	S	S	M
Kakamega	2004	15	12	S	M	M
NASPOT 8	2007	20	16	S	M	M
NASPOT 9 ('Vita')	2007	20	13	S	M	M
NASPOT 10 ('Kabode')	2007	18	12	S	M	M
NASPOT 12 O	2013	25	16	S	M	R
NASPOT 13 O	2013	38	11	S	M	R

M: Moderate; S: Susceptible; R: Resistant

Table 4: Suitability of selected sweetpotato varieties for food and feed production

Variety	Average 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

Generally,

- NASPOT 11 is a suitable dual purpose sweetpotato variety
- Harvesting vines from the local variety at 85 days after planting (de-topping) reduced yield by over 60%. De-topping leads to higher root yield in NASPOT 11
- Farmers intending to harvest vines for silage should be recommended to plant NASPOT 11.

Benefits from sweetpotato crop



- Nutrition security----source of Vit. A, B, C & E; zinc and energy
- Orange Fleshed Sweetpotato addresses Vitamin A deficiency --a major risk factor for children, pregnant and breast feeding women
- SP tubers provide a source of carbohydrates, calcium, ascorbic acid (vitamin C)
- Food security
- Source of livestock feed
- Income generation
- Soil fertility improvement----cover crop

Sweetpotato residues as livestock feed

- SP contributes about 20% of total crop residues (vines, non-commercial SP roots & peels) ----very good source of livestock feed.
- High crude protein content (19-22%)
- The residues provide an emergency supply of livestock feed during periods of dry seasons
- SP may be fed fresh, dried or ensiled
- Dried vines are used to make sweetpotato vine-based Partial Milk Substitute.

Challenges to the use of sweetpotato residues

- Sweetpotato residues are seasonal and highly perishable
- A lot of sweetpotato residues are wasted in the fields after harvesting
- Research conducted by CIP in Kamuli district in the framework of RTB-ENDURE shows that farmers waste up to 24 and 22% of the vines and non-marketable roots (Table 5)
- Pig farmers face feed scarcity in specific periods of the year (Figure 2).

Table 5: Utilization of sweet potato components by farmers

Sweetpotato component	Usage (%)						
	Food	Planting material	Animal feed	Sell	Manure	Given to neighbours	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

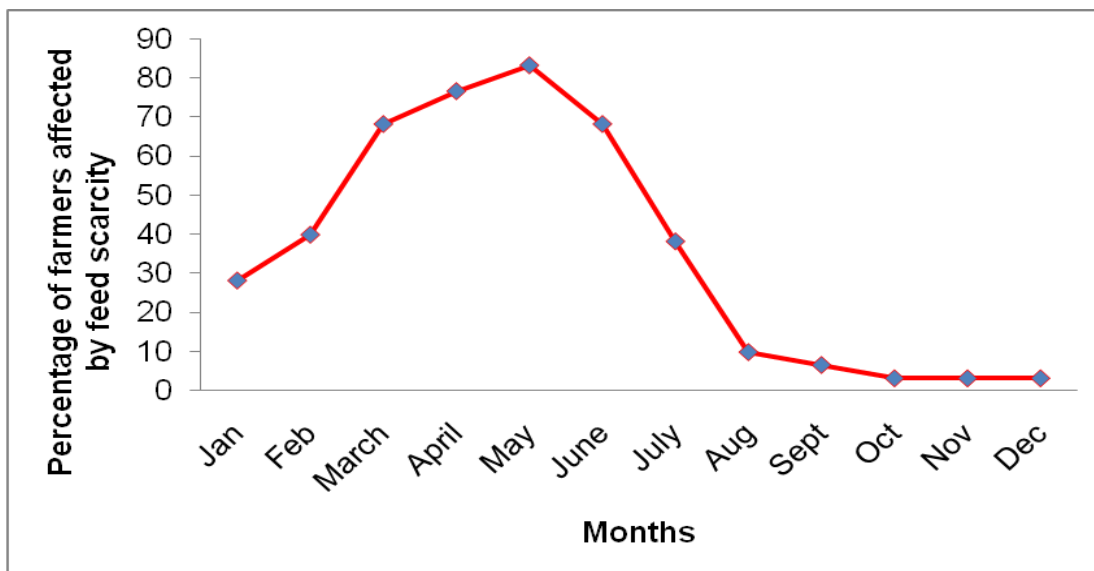


Figure 2: Percentage of pig farmers facing feed scarcity by month

What is silage?

- **Silage** is cut green plant material that is sealed in airtight silos without air and water----- a **silo** is a structure for storing bulk materials such as maize grain
- Silage is produced by the activities of naturally-occurring bacteria that convert some of the plant sugars into organic acids that preserve nutritional qualities
- Silage can be stored for many months and still have up to 85% of the energy and protein value of the original fodder crop.

Some of the forages used to make silage:

- Sweetpotato vines and roots
- Napier grass
- Sorghum
- Maize
- Sugarcane tops

Table 6 shows nutritive value of Sweetpotato vines, Napier grass, Sweetpotato vines-Napier mixture and silage.



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

Parameter	Dry matter content (%)	Crude protein (%)
Sweet potato vines (SPV)	22.2	12.1
SPV silage	26.2	16.3
Napier	16.9	13.2
Napier silage	16.4	10.3
SPV-Napier	19.8	14.2
SPV-Napier silage	22.8	13.1

Advantages of silage

- Prevents wastage of valuable feed resources
- Mitigate seasonal feed shortages
- Help cope with seasonal feed prices fluctuations that many smallholder pig farmers experience
- Provide nutrients required by the animal, which may be deficient in the diet
- Adequate feed is available all year round; hence animals remain in good health
- Silage can be made using fresh or, better, wilted material
- Silage quality is maintained for longer than is hay quality, because hay oxidizes during storage
- High silage protein content and digestibility makes it an excellent complement to grass feeds
- Silage production is one of the technologies to reduce methane gas which is also responsible for global warming
- Silage making as a service delivery is an opportunity for investments by unemployed youth who loathe agriculture as a direct employment option.

Advantages of tube silage making technology

- Provides a regular supply of high quality animal feeds, leading to good returns from the enterprise
- Promotes conservation of excess residues ensuring year-round supply of high quality feeds
- 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 sac can be re-used.

Material requirements for the tube silage making technology includes:

- ✓ Sweetpotato residues
- ✓ Black polythene tubes, 2.5metres, gauge 600-800mm,
- ✓ Maize bran or molasses
- ✓ Watering can & water
- ✓ Forage chopper or a machete
- ✓ Tarpaulin
- ✓ 100 kg sac
- ✓ Weighing scale
- ✓ Sisal twine
- ✓ 4 people to provide labour to produce 1,000 kg of silage/ day.

Silage preparation



1. The crop should be ready to harvest: the seed of forage sorghum or maize should be soft but not milky when you squeeze it open
2. Harvest or purchase sweetpotato residues
3. Spread the residues for at least one day to reduce the moisture content
4. Chop the residues into 2.5cm length pieces using a motorize forage chopper or a *panga*
5. Measure one bag of well compressed chopped residues (about 70kgs) and spread it on the canvas
6. Mix 1 litre molasses with 3 litres of water and sprinkle the mixture over the material **or** mix 1 kg of maize bran with 10 kg of chopped SP residues and mix thoroughly. **Maize bran produces better silage because it reduces the effluent from the silage**
7. Pleat the black polythene tube (about 1.5 meters long, gauge of 600-800 mm for every 70 kg of residues) lengthwise
8. 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
9. Turn the polythene bag inside out
10. Roll down or fold back the top of the polythene tube and place the tube into another synthetic sac used for packing sugar, salt, rice and maize flour.
11. The sac protects the polythene tube from being damaged by rodents and hot weather
12. Put the material in the polythene tube. You can also use plastic drums instead of the polythene tube
13. Compress the mixture firmly to exclude all the air. You can stand inside the bag and compress the mixture down thoroughly using the feet
14. Repeat the steps until the polythene tube is full
15. Add the mixture to the polythene tube in small quantities and compress until it is full
16. Hold the top of the polythene bag firmly excluding the air
17. Tie the silage material and make sure the silo is air tight. Silage is formed through anaerobic fermentation by microorganisms.

Table 7 shows estimated cost of producing 500 kgs of sweetpotato silage.

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

Material	Quantity	Unit cost (Ug.shs)	Total cost (Ug.shs)
Sweetpotato vines from own field (kgs)— includes transport and labour	500	50	25,000
Hiring a forage chopper to chop 500 kg--- includes fuel	1	30,000	20,000
Polythene material (meters) for 70 kg tube silos	10	4,000	40,000
Tarpaulin	1	30,000	30,000
Ensiling process (labour), per 100 kg	5	5,000	25,000
Sisal string (rolls)	0.5	5,000	2,500
Maize bran	50	600	30,000
Total			172,000
Cost per kg of silage (Ug.shs)			345

Other methods of making silage

Stack silo



- A plastic sheet (about 0.1 mm thick) is spread over the ground
- The material for making silage is chopped using and placed on the sheet or cemented floor
- The material is entirely covered with a plastic sheet
- Proper tread pressure has to be applied, and complete sealing is required
- The size of a silo depends on the number of animals.

Important note on stack silo

- Stack silo is suitable only for large pig farms or if large volume of sales is ensured
- If for sale, 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)
- To ensure continuous sales during key months, the production will depend on the consumption rate and the ratio between months of consumption/production.

Trench/pit silo

- A trench silo is built underground or semi-underground
- A tractor or heavy loads are used to compact the material within the silo
- Thereafter the silo is covered with a plastic sheet, weighed down with soil. This help maintain anaerobic conditions.

Sweetpotato silage utilization

- Wait for 30 days until the fermentation process is complete before use
- Carefully and step-by-step open a small portion of the silo when need arises for feeding and seal the remaining silage immediately after the removal.
- The silage made using this technology is sweet smelling and brown when ready
- Supplementing sweetpotato vines silage at a ratio of 60:40 (Silage:Concentrate) improves pig growth performance (Tables 8, 9 and 10).

Table 8: Composition and cost of concentrate diet for pigs

Ingredient	Proportion in diet (kgs)	Unit cost (Ug. Shs)	Total cost (Ugshs)
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
Vitamin premix	0.5	500	2,500
Salt	0.5	1,000	500

- The amount of silage to be fed per animal will depend on the age and weight of the animal
- Clean the feed troughs after feeding the silage
- Opened silage should be fed to the animals within 3 days.



Table 9: Average Daily gain, Feed Intake and Feed/Gain

Parameter	Control	Silage + Suppl.
Initial weight (kg)	11.61	11.49
Final weight (kg)	29.36	32.29
Daily Feed intake (kg)	1.45	1.21
Average daily gain (kg)	0.18	0.23
Feed/Gain	4.59	4.16

Table 10: Average Carcass weight, Dressing percentage and Organ weights (On-Station)

Parameter	Proportion Silage:Supplement (%)			
	100:0	80:20	60:40	0:100
Final weight	26.29	32.70	47.13	59.47
Carcass wt (kg)	13.85	19.32	29.48	41.54
Dressing %	52.09	59.09	62.56	69.86
Kidney wt (g)	60	70	100	130
Liver wt. (g)	330	520	690	820
Head wt (kg)	1.87	2.83	3.54	3.80
Backfat (cm)	0.99	1.23	1.59	2.18

How much silage should be made?

The quantity of silage to store depends on several factors such as:

- Type of animal (goats, cattle, pigs, etc.)
- How many animals are to be fed
- Weight of the animals
- For how long they are to be fed
- The storage space available
- The amount of excess feed to conserve
- Forage dry matter content
- Available labour, etc...

Conclusions

- Sweetpotato residues are a valuable feed resource in smallholder systems
- SP residues are highly perishable
- Use of SP silage can even out the supply of feed on smallholder pig farmers
- Supplementing SPV silage with a concentrate at a level of 40% improves pig growth performance at lower feeding costs.



3. Presentation by ILRI representative (Peter Lule Mulindwa)

CIP and ILRI were represented by Mr. Peter Lule who briefed farmers on the RTB-ENDURE objectives and activities. He informed participants that in both districts ILRI had carried out an assessment of the local available feed resources and pig feeding practices. The main feed related challenges (incl. quality of feeds, seasonality of the forage based feeds like sweetpotato vines) were also investigated. Therefore, in order to overcome these challenges, ILRI partnered with CIP to test, validate and promote sweetpotato silage. The reasons for the choice of sweetpotato silage were; (a). Sweetpotato vines were the most common forage-based feed given to pigs; (b) Sweetpotato is commonly grown in all parts of Uganda; and (c) ILRI had successfully pilot tested sweetpotato silage in other countries.

Mr. Lule pointed out that most of the farmers had been trained in the first year of project implementation. The purpose of this second training was to avail to them more information on how to supplement the silage and the share the project findings (e.g., weight gains for pigs fed on silage-based diet). He also indicated that silage training and business centers had been established by the project in both Kamuli and Masaka districts. These centers are open to farmers who want to hire forage choppers, buy silage and access information on silage production and utilization and other animal husbandry practices. He advised the farmers to get in touch with the silage centers.

After presenting some of the key findings from the research that had been carried out, he concluded by encouraging farmers to take up the technology as it would help in bridging the gap when maize bran is expensive and during the dry season.

4. Comments/questions from TOTs in Masaka and Kamuli districts

(i) Masaka district

- Q: Where can I get improved Napier grass varieties?
A: The National Livestock Resources Research Institute, Nakyesasa.
Q: When zero grazing had just come in Uganda, we were not using Napier grass, we used to have Guatemala grass. What happened to it?
A: The grass is fibrous when it matures and the animals tend to reject it.
Q: Are there any places where farmers can get already made silage on sale?
A: Yes, you can get silage from NaLIRRI-Nakyesasa but you can also get sweetpotato silage from *Bavubuka Twekembe* Group as well as the recently established silage training and business centers.
Q: What are the suitable storage facilities for silage?
A: The store must be well ventilated and free from rodents.
Q: The initial silage technology from Kenya had a tube at the bottom. What is the difference between that initial silage technology and the current silage technology?
A: That technology is expensive but suitable when maize bran is not available.
Q: What amounts of silage are supposed to be given to the different animals?
A: This depends on the type of animal but it is about 4 kg/day for mature pigs and about 15 kgs/day for mature cows.
Q: Can mixing hay and molasses be a feed for animals?
A: Yes but it must be supplemented with a source of protein and minerals.
Q: How have you overcome the problem of scarcity of sweetpotato vines?
A: Sweetpotato vines are seasonal and large amount go to waste during the bump harvest.



- Q: How can you compare the nutrient feed block and the silage?
A: The two are different in the nutritional quality and feeding management:
- Difference in the required ingredients
- Difference in cost of production for both feeds.
- Q: A certain farmer had pigs which were stunted in growth at six months. So he was asking what the problem was and how can he improve them?
A: They may be underfed or their health status is poor.

(ii) Kamuli district

- Q: How long can the nutritional feed block be stored?
A: It can be stored as long as you keep it dry to avoid moulding.
- Q: What are the ingredients for making the nutritional feed blocks? How many cows can feed on one nutrient feed block?
A: This is on the size of the block and weight of the animal. A cow consumes about 3% of its live weight. This means that for a cow of 400 kg, you need a block of about 12kg. This can also be fed to the animal as a Total Mixed Feed ration (TMR).
- Q: Is it possible to have pasture demonstration fields at Kamenyamiggo we can use at to demonstrate silage production?
A: You are advised to contact Mukono ZARDI.
- Q: Is there an alternative to dry nutrient feed blocks if I cannot afford to construct a simple solar drier?
A: You can sun dry them but they take long to dry properly. You have to keep turning the blocks. A simple solar drier is the best option to dry nutrient feed blocks.
- Q: Is it possible to use other materials like cassava leaves to make silage since we feed them to pigs?
A: Silage can be made from cassava leaves but you need to be very careful on the varieties. Some cassava varieties contain high level of dangerous anti-nutritional compounds.
- Q: Can silage be fed to other animals such as goats?
A: Silage can be fed to cattle, goats, rabbits and sheep.
- Q: How can you improve on the sugar content of silage?
A: You can add diluted molasses.
- Q: What are the future perspectives for this project?
A: The project ends in December. The district can allocate funds to disseminate the technology to farmers.
- Q: How can we store silage for a longer period without damage by rodents?
A: You must control the rodents using cats.
- Q: How can we get hydroponic feeds?
A: You can produce the feeds on a small scale.
- Q: Can we mix sweetpotato vines and maize when making silage?
A: You can but it might not be economic.
- Q: In the recent trials conducted at Kamenyamiggo ZARDI we mixed soybean with chopped sweetpotato vines, do you think this can be recommended?
A: Adding soybean is good because it improves the protein content of the silage but it also increases the cost of the silage.
- Q: Sweetpotato silage gets spoilt in the second year, why do you recommend this tube silage technology?
A: The tube technology is very convenient for the small scale farmers. You must make sure that you keep out air to avoid rotting.
- Q: Is salt not required when making silage?



A: You do not need salt.

5. Practical on silage making (TOTs)

The participants were involved in practical silage making conducted by the youth group members as shown in the pictures below.



Chopping sweetpotato vines





Weighing maize bran



Mixing chopped sweetpotato vines with maize bran



Mixing chopped sweetpotato vines with maize bran



An extension staff in Kamuli district fills the plastic tube silo with a mixture of chopped sweetpotato vines and maize bran



Participants fill the plastic tube silo with a mixture of chopped sweetpotato vines and maize bran



VI. Farmers training workshops in Masaka and Kamuli districts



Participants from Bugulubya sub-county, Kamuli district

Kamuli district

In Kamuli district the workshops were held at Kiwungu Baptist Church in Butansi sub-county and Bukyonza Primary School in Bukyonza village, Bugulumbya sub-county.

In Butansi the workshop was opened with a prayer by the Chairperson of Butansi Piggery Farmers' Group (BPFG), Mr. Paul Mudhasi. He informed the participants that sweetpotato silage has helped their group members to improve pig production and to empower women and youth in development by exposing them to new skills and knowledge. A total of 70 farmers (37 women and 33 men) participated in the workshop at Butansi sub-county (Annex 1). Of the 70 participants, 20 were below 35years of age.

In Bugulumbya the workshop started with an opening prayer followed by self-introductions. The introductions revealed that three (3) participants were not aware of silage as well as the topic of the training (they had just heard about a workshop and decided to attend but did not know what it was about). Of the 70 participants, 20 were below 35years of age.

During the self-introductions, farmers in Bugulubya sub-county extended their sincere appreciation to the project. They reported that:



- Their perceptions that a pig must eat in bulk to grow fast was changed
- They always had their pigs at first oestrus (heat) after 11 months but the current feeding regimes and technology have lowered it to 8 months
- They realized that they wasted a lot of feed resources but had not realized how significant the losses were
- The vines that they used to waste is what they currently use to generate money as well as feed their pigs for faster growth rates
- They also recognized the reduced time spent during the search for feed
- They no longer lament over scarce feed resources and gave an example of the current feed crisis that had not had a significant effect on their pig production systems
- They all thanked the project for having improved their market access.

Masaka district

In Masaka district the workshops were held at St. Paul Primary School, Kitovu, Senyange sub-county and at Buwunga Sub-county headquarters, Buwunga sub-county.

The training in Senyange sub-county was attended by 54 farmers (11 men and 33 women). The training in Buwunga sub-county was attended by 55 farmers (27 men and 28 women).

1. Expectations

In both districts, each participant was requested to write down at least two expectations from the workshops. They are summarized in the table below.

Buwunga sub-county	Nyendo Ssenyange sub-county
<ul style="list-style-type: none"> • Learning new things from fellow farmers • Want to learn about feeding of silage • More knowledge of profitable piggery enterprise • Want to hear the justification of silage making • Relevance of sweetpotato vines conservation • Different methods of making silage • How to form groups to get market for our products • Materials for making silage 	<ul style="list-style-type: none"> • Opportunities for silage making as a business • Get information on improved pig production • Different sweetpotato varieties • Which are the best varieties for silage production? • Market for piglets
Bugulumbya sub-county	Butansi sub-county



<ul style="list-style-type: none">• Learn about the process of silage making• Refresh our silage making skills• Understand silage storage• Learn about how to feed silage• Silage production from other resources other than sweetpotato vines• Expect to be given a forage chopper	<ul style="list-style-type: none">• Get knowledge and skills on livestock production• Skills on reducing expenditures on farm activities• Knowledge and skills to increase income• Interaction and learn new skills from each other• Learn how to utilise sweetpotato vines through silage making• How to increase income through better utilisation of sweetpotato• Get more knowledge in silage making and how to market it
--	---

2. Presentations

Mr. Vincent Lutwama (*Bavubuka Twekembe*) and Mr. John Kigongo (NaLIRRI) made presentations in Masaka and Kamuli districts. The presentations were similar to what was presented during the TOTs workshop.

3. Questions/discussion (farmers in Bugulumbya and Butansi sub-counties)

Masaka district

- Q. Is it possible to ensile *Bidens pilosa* (Black Jack) and what happens if you make silage from wondering jew?
- A. No research work has been done to evaluate the nutritive value and ensilability of *B. pilosa*. Besides, the practicability is the limitation to the successful utilization of *Bidens pilosa* as silage. For example: how much of it can you collect to make silage? The same conditions hold for production of wondering jew bases silage



Bidens pilosa



Wondering Jew

- Q. Why would you compact vines in a plastic material yet it rots when left in the banana plantation?
- A. The difference lies in the conditions prevailing. The microorganisms that facilitate decomposition prefer conditions under which oxygen is in steady supply but when you pack material inside the plastic, you provide anaerobic conditions under which these microorganisms do not thrive. The shortage of oxygen permits proliferation of microorganisms to utilize water soluble carbohydrates leading to production of lactic acid, the acid responsible for preservation of ensiled material.
- Q. Does any color of plastic tube work as a silo?
- A. The colour of plastic tubing does not matter much as long as complete anaerobic conditions are provided.
- Q. How do I get the right type of plastic tube?
- A. Most hardware shops have these plastic tube for silage production but always be vigilant when buying to avoid those with punctures or torn.
- Q. What if I dig a pit and pack my silage tubes in the pits?
- A. Where you store the tube does not matter but the key issue is protecting what is inside from the external agents.
- Q. Do you ensile non-commercial roots and vines independently?
- A. Roots and vines can be ensiled singly or together as long as you have justifiable amounts.
- Q. If silage matures after 30days, what happens if I leave it to for 40 days and what happens if I feed it before 30days elapse?
- A. Silage after 30 days has stabilized and can be kept for long periods of time unless the silage is not properly preserved.
- Q. If I stored my silage properly but found it rotten and mouldy, am I advised to go ahead and feed?
- A. Poorly preserved silage is not recommended for feeding to pigs due to the adverse side effects such as mycotoxins.
- Q. How do I introduce my goats to silage consumption?
- A. Animals tend to reject what they are not used to and therefore the introduction is done gradually until they are used to the silage.
- Q. Some extension staff taught us to make silage with inclusion of fishmeal and salt, why are we not adding them?



- A. Addition of salt to silage is geared towards prevention of mould growth in silage. However, with the current method of silage production moulds can be completely eliminated if proper procedures are followed. Addition of fishmeal may contribute positively to the protein content but may increase the costs of production of silage.

Kamuli district

- Q. Where can we get forage choppers from and how much are they?
A. You were provided with a forage chopper at the sub-county.
- Q. Can silage be made without a motorized forage chopper?
A. Yes you can make silage from sweetpotato vines chopped using simple tools such as pangas
- Q: How do you use molasses to make silage?
A: 1kg of molasses mixed in 2litres of water. Then 1 litre of this to be added to 10kgs of the material to be conserved
- Q: Do we feed sweetpotato silage to pigs only?
A: It is also fed to any other livestock like cattle, goats, among others
- Q: How do we control swine fever in pigs?
A: Controlled by hygiene, use of disinfectants and avoid pork from other places on your farm
- Q: How much concentrate can a pig of 50kgs be fed?
A: At least 2kgs per day
- Q: Does inbreeding in pigs have an effect on piglets?
A: Stunted growth
- Q: At what stage or age do we wean piglets?
A: At 2 months of age
- Q: Can sweetpotato silage be used as fattener in pigs?
A: Sweetpotato silage is good as a source of feed to fatten pigs but in addition concentrates are also required
- Q: Marketing of pigs and piglets is still a major problem in farming, how can this be solved?
A: By forming farmers' groups or cooperatives so as to have one common interest and market
- Q: While making sweetpotato silage, do we use leaves only?
A: Both vines and stalks
- Q: Is there any vaccine against African Swine Fever (ASF)?
A: Not yet developed
- Q: Can soybean replace fishmeal during concentrate formulation?
A: Both can be used depending on the availability of the materials
- Q: What could be the best way to store the silo bags?
A: Where there are not rats and avoid storing under direct sunlight
- Q: Do you add mineral powder while making silage?
A: Not necessary
- Q: Can you use molasses and maize bran at same time to conserve sweetpotato residues?
A: Just need to use one additive
- Q: Is it possible to feed silage and maize bran at a ago?



- A: Yes, but maize bran should be mixed with other ingredients like fishmeal, minerals, etc, to make a concentrate.
- Q: Can you make silage from cassava leaves?
- A: Yes, since cassava leaves contain cyanide this helps to reduce it.
- Q: Is it recommended to cook sweetpotato peels before feeding them to pigs?
- A: Yes, but they should not be overcooked
- Q: If banana stems are chopped into small pieces, can they be fed to pigs too?
- A: Not recommended because they are too fibrous to be fed to pigs.

4. Practical session on silage making in Masaka and Kamuli districts

The Bavubuka Tweekembe Group demonstrated silage making using the polythene tube technology.



Demonstration in Buwunga sub-county, Masaka district



Demonstration in Bugulumba sub-county, Kamuli district



Adding additive (maize bran) to chopped vines



How to make a silo bag



Compaction of vines in a silo bag



Ensilaged sweet potato vines

Pictures taken during practical in Butansi sub-county, Kamuli district



VII. Workshop evaluation

Participants were requested to list down key lessons learned and new experiences from the workshop:

- Some farmers reported that the use of sweetpotato silage on their farms have saved them time and labour to look for alternative sources of feeds whose quality is very low
- Silage also increase pig production because of increased growth rate and the quality of the pork (not fatty)
- Partial substitution of maize bran with silage has also reduced their feeding costs
- Some farmers indicated to be able to sell silage to earn their living
- The youth in the community who are not able to make silage, can now sell vines to farmers who make silage
- There is a need to mobilize the youth into groups and to equip them with skills on commercial sweetpotato silage production
- The district extension staff appreciated the training and proposed to strengthen collaboration with NARO/NaLIRRI.
- This is an integrated project which involves women, men and youth of Butansi sub-county
- Training was simplified, participatory and practical enough
- Training was brief
- We can use locally available materials like the sweetpotato residues to feed livestock
- The training has covered a number of key aspects on nutrition in livestock management
- I have appreciate you for sharing vital information with us.
- I have been motivated to make utilization of the limited resources to earn income
- You are well informed on issues concerning livestock nutrition
- Silage production as a commercial enterprise is a new experience for the youth. We have to encourage unemployed youth to star making silage for sale
- The workshop has been an eye opener for all of us. We realized that we can cut down the cost of feeding pigs during the dry season by ensiling sweetpotato residues
- Marketing pigs can be improved through group formation
- Commercial silage production is labour intensive. Availability of low cost forage choppers is a key requirement to commercial silage production.



ANNEXES

Annex 1. Workshop Program

Programme for Training of Trainers and farmer workshops in Kamuli and Masaka districts		
Time	Activity	Responsible person
8.00-8.30am	<ul style="list-style-type: none"> Registration 	Extension staff
8.30-9.00am	<ul style="list-style-type: none"> Opening prayer Select a rapporteur Self-introduction (name, institution/district and experience on sweetpotatoes as a food and fodder crop). 	Participants
9.00-9.20am	<ul style="list-style-type: none"> Participants expectations 	
9.20-10.10am	Sweetpotato silage as pig feed resource ENDURE-RTB project	Dr. Jolly Kabirizi, NaLIRRI Mr. Lule (CIP)
10.10-10.40am	Questions/Discussion	
10.40-11.10am	BREAK TEA	
11.10 am-12.30pm	Questions/Discussion	
12.30-1.30pm	Silage making practical	Dr. Jolly Kabirizi Mr. Vincent Lutwama Mr. John Kigongo Mr. Dana Isabirye
1.30-2.30pm	LUNCH	
2.30-4.00pm	Discussion, Evaluation of the workshop and way forward	Dr. Jolly Kabirizi
4.00pm	Closing and Departure	Dr. Jolly Kabirizi



Annex 2. List of participants

1. MASAKA DISTRICT

List of ToT participants

Name	Gender (F/M)	Organization
1. Serwadda Joseph	Male	Masaka District Local Government (MDLG)
2. Serwanyiri Henry	Male	(MDLG)
3. Namayanja Sarah	Female	(MDLG)
4. Kaddu Samuel	Male	(MDLG)
5. Kanamwngi Bonny	Male	(MDLG)
6. Tomusange Eridad	Male	(MDLG)
7. Sserwaniko Thomas	Male	(MDLG)
8. Balisnyuka Daniel	Male	(MDLG)
9. Namuddu Margaret	Female	(MDLG)
10. Biira Juliet	Male	Kamenyamiggo ZARDI
11. Luwedde Mariam	Female	Kamenyamiggo ZARDI
12. Ssekabunga Ncholas	Male	Kamenyamiggo ZARDI
13. Mayega Lawrence	Male	(MDLG)
14. Nakatudde Patricia	Female	(MDLG)
15. Kabirizi Jolly	Female	NARO-NaLIRRI
16. Ssempagala Henry	Male	NARO-NaLIRRI

List of farmers

Name (Farmers)	Gender (Male/Female)	Sub-county	Village
1. Bamutalira P	Female	Nyendo Ssenyange	St. Henry's Kitovu
2. Nakibuuka Teddy	Female	Nyendo Ssenyange	Ssenyange
3. Namazzi Ruth	Female		
4. Nakitto Margaret	Female	Nyendo Ssenyange	
5. Sekajja Lawrence	Male	Nyendo Ssenyange	Kitovu
6. Mwatosifudde Stephen	Male	Mpugwe	Kateera
7. Katongole Matia	Male	Nyendo Ssenyange	Kayirikiti
8. Nampijja Gorreti	Female	Nyendo Ssenyange	Kayirikiti
9. Namulindwa Betty	Female	Nyendo Ssenyange	Ssenyange
10. Nakamanya Gertulide	Female	Nyendo Ssenyange	Ssenyange
11. Nabukeera	Female	Nyendo Ssenyange	Ssenyange
12. Ssalongo Muwonge Joseph	Male	Nyendo Ssenyange	Kitovu
13. Nakato Jane	Female	Nyendo Ssenyange	Kitovu
14. Naggayi J	Female	Nyendo Ssenyange	Kitovu
15. Nassimbwa Teo	Female	Nyendo Ssenyange	Kayirikiti
16. Ssenkundu B	Male	Katwe	Misuuna



Name (Farmers)	Gender (Male/Female)	Sub-county	Village
17. Ssenkumbba Simon Peter	Male	Nyendo Ssenyange	Kayirikiti
18. SekyondwaF	Male	Mukungwe	Nyendo Kasana
19. Mubiru Paul	Male	Nyendo Ssenyange	Nakayiba
20. Mugeru Godfrey	Male	Nyendo Ssenyange	Kateera
21. Wasswa Peter	Male	Nyendo Ssenyange	Nakayiba
22. Nanono Diana	Female	Nyendo Ssenyange	Ssenyange
23. Nnassimbwa Maria	Female	Nyendo Ssenyange	Ssenyange
24. Kiggundu George	Male	Nyendo Ssenyange	Ssenyange
25. Birungi Stella Nsubuga	Female	Nyendo Ssenyange	Ssenyange
26. Nakidde Mara Gorretti	Female	Nyendo Ssenyange	Ssenyange
27. Nandawula Regina	Female	Nyendo Ssenyange	Kinsadde
28. Nantabaaazi Immy	Female	Nyendo Ssenyange	Ssenyange
29. Kabugo William	Male	Nyendo Ssenyange	Ssenyange
30. Sserwadda Joseph	Male	Nyendo Ssenyange	Kitovu
31. Lubega Vincent	Male	Nyendo Ssenyange	Ssenyange
32. Nakakeeto Mary	Female	Nyendo Ssenyange	Buggyanjeru
33. Nakintu Siephania	Female	Nyendo Ssenyange	Ssenyange
34. Muguluma Dorothy	Female	Nyendo Ssenyange	Ssenyange
35. Naluggya Susan	Female	Nyendo Ssenyange	Ssenyange
36. Nakidde Justine	Female	Nyendo Ssenyange	Ssenyange
37. Namanda Gertulide	Female	Nyendo Ssenyange	Ssenyange
38. Ntare Charles	Male	Mukungwe	Kitovu
39. Nalubega Gertulida	Female	Nyendo Ssenyange	Nyendo Kasana
40. Kananda Patrick	Male	Nyendo Ssenyange	Kitovu
41. Nakawesi Justine	Male	Nyendo Ssenyange	Kitovu
42. Nabbale Berna	Female	Nyendo Ssenyange	Kitovu
43. Mukashyaka A.	Female	Nyendo Ssenyange	Ssenyange
44. Mugenyi Martin	Male	Nyendo Ssenyange	Bchulo
45. Bwanka Annet	Female	Nyendo Ssenyange	Ssenyange
46. Nalubega Jane	Female	Nyendo Ssenyange	Ssenyange
47. Lubega Jane	Female	Nyendo Ssenyange	Ssenyange
48. Ssemaganda P	Male	Nyendo Ssenyange	Kayirikiti
49. Katalaga Mugagga	Male	Kimanya Kyabakuza	Kyabakuza
50. Nabatanda Jane	Female	Nyendo Ssenyange	Kitovu
51. Kababiito Teo	Female	Nyendo Ssenyange	Kitovu
52. Nvannungi Teo	Female	Nyendo Ssenyange	Mukudde
53. Kirumira Willy	Male	Wakiso	Seguku
54. Sentambi Margaret	Female	Wakiso	Seguku



2. KAMULI DISTRICT

List of ToT participants

Name	Gender (M=male; F=Female)	Sub-county	Village
1. Muwereza Yona	M	Kisozi	S/C
2. Tigatoola Mubarak	M	Namwendwa	s/c
3. Kabalimu Farida	F	Namasagali	S/C
4. Isabirye Robert	M	Namwendwa	S/C
5. Nanyolo Milly	F	Kitayunjywa	S/C
6. Lubaale Moses	M	Butansi Nabwigula	S/C
7. Kasulobodhe Emmanuel	M	Vedco	
8. Mpaulo James F	M	Dao	KDL5 HETRS
9. Daudi.R.Mutekanga	M	Nawanyago	BUWAIBALE
10. Saada Kitimbo	F	Sabawali Bunangwe	S/C
11. Balibuzani Ronald	M	Vedco	
12. Isabirye Charles	F	Mbulamuti	S/C
13. Musenero Richard	M	Dpmo Kamuli	
14. Buwoya Johukivu	M	Ao.Kitayungwa	
15. Wagose.P.Fredrick	M	Nabwigulu	
16. Afanana Joseph	M	Labtech Kamuli	
17. Naaya Cnarles	M	Ao-Butansi	
18. Wakaisuka .M.Tafasi	F	Ao-Namasagali	
19. Nassali Immy Christine	F	Nawanyago	
20. Mudankanu Goerge William	M	Kisozi A.V.O	
21. Boyi Sanon	M	Magogo	
22. Kagoda Winfred	M	Wankole	
23. Babirye Daphine	F	Bulopa A.P.O	
24. Alupo Bena	F	Wankole Apo	

List of farmers in Bugulumya sub county

Name	Gender	Sub-county	Village
1. Kizito Nsubuga	M	Municipality	Kamuli
2. Magada James	M	Bugulumbya	Bukanako-B
3. Badagawa James	M	Bugulumbya	Sasambire
4. Sodo Godfrey	M	Bugulumbya	Butefula
5. Sodo Moses M	M	Bugulumbya	Butefula



6. Saida Tubaleke	F	Bugulumbya	Bukyonza
7. Irene Sodo	F	Bugulumbya	Butefula
8. Buyinza Jonathan	M	Bugulumbya	Bukanako-B
9. Tapenensi Kirunda	F	Bugulumbya	Busobo
10. Louisa	F	Bugulumbya	Bukyonza
11. Nangobi M	F	Bugulumbya	Bukyonza
12. Kirande.L.	F	Bugulumbya	Bukyonza
13. Batwawula Steven	M	Bugulumbya	Kasambia
14. Namagaya Josepher	F	Bugulumbya	Kasambia
15. Kiika Patrick	M	Bugulumbya	Kasambia
16. Musoke Yeseri	M	Bugulumbya	Bugulumbya
17. Mwangu Steven	M	Bugulumbya	Baluboinewa
18. Bamukyaye M.	M	Bogot	Nawanede
19. Twinomujuni	M	Bugulumbya	Bugalasi
20. Saada Mida	F	Bugulumbya	Bugalasi
21. Tdama John	M		Nawanende
22. Nadiope Musa	M	Bugulumbya	Bukyonza
23. Gabula Kuwaye	M	Bugulumbya	Bukyonza
24. Namukose Rose	F	Bugulumbya	Bugulusi
25. Nawabiro Susan	F	Bugulumbya	Bugulusi
26. Nambozo Costa	F	Bugulumbya	Bugulusi
27. Balibuze Petero	M	Bugulumbya	Bugulusi
28. Myahasi Ronni	M	Bugulumbya	Bugulusi
29. Namugonza Edith	F	Bugulumbya	Nawanende
30. Edisa Mukose	F	Bugulumbya	Nawanende
31. Mida Isacc	M	Bugulumbya	Nawanende
32. Muwanika Fato	M	Bugulumbya	Nawanende
33. Muwada Rose	F	Bugulumbya	Nawanende
34. Kizito Andrew	M	Bugulumbya	Nawanende
35. Asiiimwe Dan	M	Bugulumbya	Nawanende
36. Margret Namukose	F	Bugulumbya	Nawenende
37. Kayaga Florence	F	Bugulumbya	Kasambia
38. Kisakya Sarah	F	Bugulumbya	Kasambia
39. Scovia Magoba	F	Bugulumbya	Nawanende
40. Lwokyaza John	M	Bugulumbya	Nawanende
41. Tofu Muzungu	F	Bugulumbya	Kasambira
42. Mulumba Hellen	F	Bukyonza	Kasambira
43. Baisi Tereza	F	Bukyonza	Kasambira
44. Kawoozo Joyce	F	Bukyonza	Kasambira
45. Seteveni Basoga	M	Bugulumbya	Bukyonza
46. Saama Sanono	M	Bugulumbya	Kasambia



47. Namulawa Yusuf	M	Bugulumbya	Bukapere B
48. Mudondo.L.	F	Bugulumbya	Bukapere B
49. Konso Ruth	F	Bugulumbya	Bukyonza
50. Mandwa Justine	F	Bugulumbya	Nabirama
51. Tuuta Calherene	F	Bugulumbya	Kasambira
52. Kintu Paddy	M	Bugulumbya	Kasambira
53. Musoga Isabirye	F	Bugulumbya	Nawanende
54. Nabirye.J.	F	Bugulumbya	Nawanende
55. Nambwogwe	F	Bugulumbya	Kasambira
56. Kayiwa .M	F	Bugulumbya	Kasambira
57. Namuyomba Rebecca	F	Bugulumbya	Nawanende
58. Nabirye Ester	F	Bugulumbya	Bukyonza
59. Kiyuba Betty	F	Bugulumbya	Bukyonza
60. Kisito Peter	M	Bugulumbya	Kasambira
61. Mulongo Simon	M	Bugulumbya	Kasambira
62. Mulwooza Juliet	F	Bugulumbya	Nawanende
63. Bikumbi	F	Bugulumbya	Nawanende
64. Namusoke	F	Bugulumbya	Nawanende
65. Taz VK	F	Kasambira	
66. Namuyingo Petu	F	Kasambira	
67. Tikalika Margret	F	Kasambira	
68. Birabwa K . Hariet	F	Kasambira	Bukyonza A.
69. Edith Nugaba	F	Kasambira	Bukyonza
70. Namukose Besi	F	Bugulumbya	Nawanende

List of farmers in Busimbi sub-county

Name	Gender(M=male; F=female)	Sub-county	Village
1. Tape Ngonzi	F	Butansi	Kibumba
2. Annet Idaama	F	Butansi	Bayagowa
3. Betty Mugoberezi	F	Butansi	Kibumba
4. Nakawoma Florence	F	Butansi	Kiwungu
5. Namuwaya Elizabeth	F	Butansi	Kibumba
6. Namuwaya Harriet	F	Butansi	Kibumba
7. Bwite Rose	F	Butansi	Busige
8. Nakandi Loy	F	Butansi	Busige
9. Nabirye Edith	F	Butansi	Busige
10. Muyangu Wilber	M	Butansi	Busaamo
11. Mirembe Betty	F	Butansi	Bulunga
12. Isabirye Eriot	M	Butansi	Bulunga
13. Kasudhu John	M	Butansi	Kiwungu
14. Mudhasi Paul	M	Butansi	Kiwungu
15. Luvunya Jackson	M	Butansi	Bugeywa



16. Mivule Paul	M	Butansi	Kiwungu
17. Mudondo Sylvia	F	Butansi	Kiwungu
18. Kaabaale Francis	M	Butansi	Bugeywa
19. Akaalimwine Ruth	F	Butansi	Bugeywa
20. Bulumba Derick	M	Butansi	Bugeywa
21. Mbeiza Ruth	F	Butansi	Bugeywa
22. Kibirango Robert	M	Butansi	Kiwungu
23. Kigongo John	M	(Na Lirri)	(Naro)
24. Ngobi Denis	M	Butansi	Bugeywa
25. Alitwala Sarah	F	Butansi	Bugeywa
26. Beth Yatesa	F	Butansi	Bugeywa
27. Mudiima B	F	Butansi	Kiwungu
28. Emma Buluyo	M	Butansi	Kiwungu
29. Kibirango Robert	M	Butansi	Kiwungu
30. Nasimbwa Florence	F	Butansi	Bugeywa
31. Adikini Robina	F	Butansi	Bugeywa
32. Waimaga Mary	F	Butansi	Bugeywa
33. Luci Buyula	F	Butansi	Bugeywa
34. Ndaaba Henry	M	Butansi	Bugeywa
35. Waiswa	M	Butansi	Bugeywa
36. Midda Felix	M	Butansi	Kiwungu
37. Mutebi Alex	M	Butansi	Bugeywa
38. Nangobi	F	Butansi	Bugeywa
39. Kajja Gord	M	Butansi	Bugeywa
40. Nabirye Annet	F	Butansi	Bulunga
41. Ntono Beys	F	Butansi	Bugeywa
42. Nabirye Zodekia	F	Butansi	Bugeywa
43. Balikitanda Kaloli	M	Butansi	Kiwungu T/C
44. Lubaaly	M	Butansi	Kiwungu T/C
45. Bogere J	M	Butansi	Busige
46. Nakyanzi Veronic	F	Butansi	Kiwungu T/C
47. Ndaye J	M	Butansi	Buleebe
48. Irene Mulungw	F	Butansi	Buleebe
49. Lukolobe Paul	M	Butansi	Buleebe
50. Nasimu Nabirye	F	Butansi	Buleebe
51. Mbago	M	Butansi	Busamo
52. Kwaso	M	Butansi	Busamo
53. Bulamu Monic	F	Butansi	Bugeywa
54. Nangobi Rose	F	Butansi	Bugeywa
55. Nabirye Esther	F	Butansi	Bugeywa
56. Isabirye Joy	F	Kiwawyo	Batosa
57. Dauson J	M	Butansi	Bulunga
58. Isabirye David	M	Butansi	Bulunga
59. Alice Kikomoko	F	Butansi	Bulunga
60. Wakiso	M	Butansi	Bulunga
61. Nambi	F	Butansi	Buleebe
62. Lubuuga	F	Butansi	Buleebe
63. Induka M	M	Butansi	Buleebe
64. Luganda J	M	Butansi	Buleebe
65. Walumbe		Butansi	Buleebe
66. Bakita	F	Butansi	Buleebe
67. Babirye Annet	F	Butansi	Bulunga
68. Bagula Alon	M	Butansi	Bulunga
69. Sanoni Mwangwa	M	Butansi	Bulunga
70. Kalame	M	Butansi	Bulunga



71. Ngobi John	M	Butansi	Bulunga
----------------	---	---------	---------



RESEARCH
PROGRAM ON
Roots, Tubers
and Bananas



A broad alliance of
research-for-development
stakeholders & partners



www.rtb.cgiar.org