Improving The Livelihoods of Small-Scale Sweetpotato Farmers In Central Uganda Through A Crop Post-Harvest Based Innovation System

Proceedings of the Training of Trainers Workshop on Sweet potato Post-Harvest Technologies And Marketing

Held at Hotel Garden Hotel, Kawempe,
September 1st-3rd 2003

Organized by coalition partners with support of DFID

TABLE OF CONTENTS **PAGE**

Glossary of Words and Acronyms

PRAPACE	Regional Network for the Improvement of Potato and Sweetpotato
DFID	Department For International Development
CPHP	Crop Post-Harvest Programme
NAARI	Namulonge Agricultural Research Institute
KARI	Kawanda Agricultural and Animal production Research Institute
BUCADEF	Buganda Cultural and Development Foundation
MAK-FST	Makerere university – Department of Food Science and Technology
HORTEXA	Horticultural Exporters' Association of Uganda
BRIBTE	Buganda Royal Institute of Business and Technical Education
CIP	International Potato Center
FOSRI	Food Science and Technology Research Institute
PEAP	Poverty Eradication Action Plan
PMA	Plan for Modernization of Agriculture
NARO	National Agricultural Research Organization
EUREP-GAP	Euro-retailer Produce Working Group
CAO	Chief Administrative Officer

EXECUTIVE SUMMARY

The coalition Partners of Crop Post Harvest Programme – East African Sweet Potato in Uganda organized a 3-day training of trainers' workshop on post-harvest handling and marketing of sweetpotato for Advisors/extension workers, farmer group leaders and school teachers from the 1st –3rd September 2003. The workshop was held with financial support from DFID.

The workshop objectives were:

- To equip advisors/extension workers, group leaders and school teachers with knowledge and skills of post harvest handling and marketing technologies.
- To develop an action plan for training members of schools and communities in the skills gained.

The participants were drawn from the three-project areas of Kiboga, Luwero and Mpigi districts. There were also participants from the surrounding areas of Kampala, Wakiso and Mukono districts. The workshop methodology was highly participatory including group work and brainstorming sessions. The following are the main topics that were covered in the workshop:

1. Importance of sweetpotato for economic development & pre-harvest factors affecting post-harvest quality of sweetpotato.
2. Quality aspects of sweetpotato roots for both local and export market
3. Nutritional value of sweetpotato
4. Post-harvest handling of sweetpotato roots and its products
5. Sweetpotato marketing in Central Uganda
6. Storage technologies of sweetpotato
7. Handling of fresh produce for export
8. Processing aspects of sweetpotato
9. Action planning

The participants appreciated the workshop approach although there was a general feeling that more time was required to make the training even more beneficial as more important topics could be covered.

The participants discussed the way forward and made action plans. The following activities would be undertaken:

- Identification of farmer groups
- Mobilization and sensitization of communities and schools
- Dissemination of the knowledge and skills acquired from the workshop
- Demonstrations on storage and processing practices
- Sharing ideas and experiences with farmers
- Setting up of demonstration sites on storage and processing

1.0 INTRODUCTION

This report presents proceedings of Training of Trainers' workshop, which was organized by the Coalition Partners. The workshop was held at Hotel Garden, Kampala from 1st – 3rd September 2003. Participants were advisors/Extension workers, farmers' group leaders, and school teachers from the project area of Luwero, Kiboga, and Mpigi districts. There were also some participants from the neighbouring districts of Kampala, Wakiso and Mukono. Twenty –three (23) participants attended (see appendix 4).
The workshop was organized with financial support from DFID.

1.1 BACKGROUND

The coalition Partners of Crop Post-Harvest Programme – East African SweetPotato in Uganda are implementing a DFID Funded post-harvest project on sweet potato in 3 Districts of Mpigi, Kiboga and Luwero Districts. The partners in this Coalition Project include the National Agricultural Research Organization (NARO), Buganda Cultural and Development Foundation (BUCADEF), Makerere university – Department of Food Science and Technology (MAK-FST), the Horticultural Exporters' Association of Uganda (HORTEXA), Farmers, Institutes of Learning, the International Potato Center (CIP) and the Regional network for the improvement of potato and sweetpotato (PRAPACE). The project is aimed at conducting research and development activities in storage, processing, product development and marketing of sweetpotato to help growers improve food security, nutrition and income.

1.2 WORKSHOP OBJECTIVES

The main objectives of the workshop were:

- To equip advisors/extension workers, group leaders and school teachers with knowledge and skills of post harvest handling and marketing technologies.
- To develop an action plan for training members of schools and communities in the skills gained.

1.3 WORKSHOP DESIGN

1.3.1 Approach

The approach used was highly participatory to allow lively debate and exchange of ideas among participants.

1.3.1 Methods

a) Presentations: Presentations were made on various topics (see programme in appendix 1). These were followed with discussions.
b) Group discussions: Following each presentation, participants were allowed to discuss both in groups and plenary on matters arising which enabled them to share experiences and to get more clarification.

c) Field visits: These were done on assumption that *seeing is believing.*

d) Practicals: These were done to enable participants to have hands on experience especially on storage and processing.

e) Use of energizers: Mainly to have lively atmosphere.

1.4 EXPECTED WORKSHOP OUTPUTS

- 25 Trainers of Trainers trained in post-harvest technologies and marketing.
- Workshop report
- Action plans by trained teams

1.5 EXPECTED WORKSHOP OUTCOMES

- Better understanding of sweetpotato post-harvest technologies and marketing
- Post-harvest handling and marketing skills and techniques of the trainees strengthened
- Increased level of participation in the coalition project
- Collaboration and partnership between the managing partner (PRAPACE) and other institutions strengthened.
- Multiplier effect as the trained teams will conduct trainings in their districts under
  the coalition project

2.0 CLIMATE SETTING

Self-Introductions
Participants were paired up and requested to introduce each other using the following format;

- Names
- Names preferred
- District
- Institution
- Designation
- Expectations

- Fears
- Own contribution
- Other comments

The key output was as follows:

a) Expectations

- To be equipped with knowledge about sweetpotato production, post-harvest handling, processing and marketing
- To share field experience in sweetpotato post-harvest handling and marketing
- To network with others
- To learn about traceability and Euro-gap regulations
- To improve on training and communication skills
- To get skills for income generation from sweetpotato
- To learn practical approaches for mobilizing communities to invest in sweetpotato growing
- To get a certificate
- To learn about value addition
- To know the different products we get from sweetpotato
- To know the possible markets for sweetpotato
- To acquire knowledge and then pass it onto to students who will pass it onto their parents
- To learn about pricing of sweetpotato

b) Fears

- Time too short to exhaustively cover all topics
- Language barrier may affect participants' contribution in the workshop

c) Institutions representation

The institution were presented as follows:

i) Organization

- BUCADEF
- HORTEXA
- PRAPACE

ii) University

- MAK-FST

iii) Schools/College

- BRIBTE
- Samia Memorial College

iv) Research Institutes

- KARI
- FOSRI
- NAARI

v) Farmers' groups

- Beera Mwesigwa farmers' group
- Kanoni Small Business Association
- Tusitukirewamu Kabulanaka Farmers' group
- Kinakulya Kakuuto Farmers' group

d) Contract of work

The participants agreed on the following code of conduct:

- Show of hands for ones' participation
- Observe time
- Participate maximally
- Respect each other
- Avoid unnecessary movements
- Mobile phones in low tone
- Avoid absenteeism

3.0 OPENING REMARKS

3.1 Remarks by Project Field Officer- Coalition Project

The Project field Officer, Mrs. Immaculate Sekitto welcomed participants. She gave a background to the Coalition Project, workshop and outlined the workshop objectives as listed in 1.2 above. She informed participants that the workshop was the first of its kind that the Coalition partners project was organizing, and called for their full participation in the workshop in order to benefit maximally. She thanked all those who had participated in the pre-workshop organization, recognized the support of DFID, which had enabled the workshop to be held. She wished the participants fruitful deliberations and invited the Regional Coordinator from DFID office to give remarks on behalf of DFID.

3.2 Remarks by Regional Coordinator, DFID

The Regional Coordinator of East African Region as well as the Manager of Crop Post-Harvest Programme (CPHP), Dr. Daniel Kisauzi informed participants that the main aim of funding the Coalition project was to improve on crop post-harvest handling, storage, value addition, marketing and generation of market information. This was done after realizing that farmers were producing but lacked markets and market information. He appealed to participants to aways make use of schools as markets for sweetpotato, and that children could be used as channels of dissemination of sweetpotato technologies to communities.

3.3 Remarks by from Managing Partner.
The Managing Partner/PRAPACE, Dr. Berga Lemaga urged participants to participate fully, share their field experiences, and come up with innovative ideas that could be adopted in the sweetpotato coalition project. He then invited the guest of honor to officially open the workshop.

3.4 Opening Remarks by Director NAARI
The Director NAARI, Dr. Fina Opio officiated at the opening of the workshop. She reiterated government initiative to eradicate poverty by shifting emphasis to the farmer. She said government put in place policies of Poverty Eradication Action Plan (PEAP) and the Plan For Modernization of Agriculture (PMA) mainly to change farmers thinking to look at farming as a business.

Dr. Opio told participants that Uganda was the leading producer of sweetpotato in Africa and the second producer in the world. However, she expressed concern over the prevailing status of agriculture in which farmers cannot compete with quality sweetpotato products on the market and have money in their pockets. She said researchers have developed high yielding sweetpotato varieties like NASPORT and some farmers' have managed to get market. She gave an example of Mr. Rajabu from Luwero district who built a house from selling sweetpotato and named it NASPORT, and another farmer Mr. Kabugo from the same district who bought a car from selling sweetpotato.

She told participants that when researchers developed the orange-fleshed potato, it was not accepted, but with value addition it was now acceptable. Maganjo Processors have added value by making sweetpotato flour, which was now very enjoyable to children. She stressed the need for quality production, value addition, proper packaging, and competitive marketing which were big challenges today. She called for good partnership, which involved working together with farmers, extension workers, researchers, processors, exporters and schools, if we were to commercialize agriculture. She ended by wishing participants fruitful deliberations and declared the workshop officially open.

4.0 WORKSHOP PROCEEDINGS

A number of papers and reports were presented during the workshop. Below is a summary of the sessions.

SESSION 1

4.1 Importance Of Sweetpotato For Economic Development & Pre-Harvest Factors Affecting Post-Harvest Quality Of Sweetpotato.
By Charles S. Niringiye

His presentation dwelt on the various uses of sweetpotato both for food and income generation. He also outlined the pre-harvest factors that affect post-

harvest quality of sweetpotato as: soil type, variety, health of planting materials, time of planting, time of weeding and soil fertility. Following his presentation, participants were subdivided into 3 groups to discuss matters arising as well as their experiences on pre-harvest factors affecting quality of sweetpotato. Below is the summary of the output of the group work and the reactions.

Group discussion on Experiences on pre-harvest factors affecting the quality of sweetpotato.

The participants' views on pre-harvest factors affecting quality of sweetpotato were:

- Soil fertility is a problem to some farmers
- Varieties of sweetpotato do differ in their mealiness and other attributes
- Timing of planting is a problem due to the uncertainty of the rains
- Length and shape of ridge and mounds, does impact on quality
- Length of vines, time of storage before planting and scarcity of vines is also an important issue
- Weed control is important and does impact on quality
- Pests and diseases do impact on quality
- Unreliability of rains affects quality
- Some farmers lack appropriate agronomic techniques
- Rodents were recognized as a menace in the field

Reactions to the above concerns

- Light soils were ideal and heavy clay soils should be avoided. Also farmers should avoid growing sweetpotato in very fertile areas as root formation is minimal in the very fertile areas
- Certain varieties do better than others. Each region has a variety that does best in that particular area. Participants also noted that *NASPORT* 4 is more mealy than other varieties so farmers should be encouraged to grow *NASPOT 4.*
- Certain varieties are scarce and there is need to increase propagation of planting materials.
- Vines are often infected with viruses as they mature, so farmers were advised to screen and discard the infected vines
- Timing of planting is very important and has an impact on quantity; early-planted sweetpotato yields are higher and less susceptible to pests and diseases. It was agreed however that uncertainty of the rains is still a major problem to farmers.
- Vines of 1 foot (30 cm) are appropriate and should be planted immediately
- Weeds be controlled immediately in order to reduce competition with the vines. Late weed control leads to small tuber sizes

- Integrated pest management techniques be employed in pest and disease control systems
- Inappropriate agronomic practices. It was emphasized that during weeding and also when performing other field activities, care should be taken to minimize root ddamage
- Rodents should be controlled in all ways possible for they destroy a lot of tubers leading to quality decline. Use of *Tephrosia spp* was recommended as a very is to be very effective

SESSION 2

4.2 Quality Aspects Of Sweetpotato Roots For Both Local And Export Market
By Simon Kaggwa

Mr Simon Kaggwa highlighted the various attributes to quality of sweetpotato with regard to local and export markets as variety, size, shape, nutritional content and appearance. He also discussed the Euro-retailer Produce Working Group (EUREP-GAP) whose objective was to agree on standards and procedures for development of good agricultural practices. After his presentation participants discussed their field experiences on local and Export markets in groups. Below is the output of the group work and the reactions.

Group discussion on Experiences on quality issues for both local and export market

Participants' experiences were:

Local Markets

- Size and shape were not important factors for the local market, but some varieties out compete others on the local market, for example *Mbale* type is preferred to other varieties

- Middlemen are very critical of quality and usually pay higher prices for quality tubers

- Middlemen were a threat to the SP industry

- Skin colour was important for the local market

- Taste and mealiness are quality attributes that some local consumers consider.

Reactions

- Quality for the local market is very important just like the export market and there is need to improve quality if high premiums are to be recognized.
- Formation of strong farmer groups by farmers is the way forward, these farmer groups act as bargaining agents and in a way middlemen are removed from the chain
- Participants were advised to increase the growing of tasty and mealy varieties that are desired by the local market.

Export markets

- Most participants had minimal or no experience at all with export markets.
- Market is very critical of quality issues e.g skin colour, shape and size of the tubers
- Price offered on the export market is higher than the price offered on the local market
- Despite the potential of the export market, storage infrastructure is lacking in most growing areas

Reactions

- For the export market, quality is a must.
- For storage infrastructure, the government intervention project has so far built three pack houses in Mpigi, Luwero and Mubende. These are to act as collecting centres; it is expected that in the long run the quality of exports will be improved.

SESSION 3

4.3: Nutritional Value Of Sweetpotato
By Dr. Agnes Namutebi

This was the first presentation on day two after the participants had done a recap of day one. The paper was on SP nutrients and their functions; the effects of post-harvest handling on the nutritional value of SP products. Some of the effects discussed included; reduced moisture through drying out of roots, effect of high temperature, changes in atmospheric composition.

SESSION 4

4.4: Post-Harvest Handling Of Sweetpotato Roots And Its Products
By Dr. Agnes Namutebi

Dr Namutebi presented highlights of SP characteristics, post-harvest period, post-harvest losses, maturity status for the market, maturity indices and post-harvest handling.

SESSION 5

4.5: Sweetpotato Marketing in Central Uganda
By Kelly Wanda

Mr. Wanda's presentation dwelt on issues and challenges of SP marketing for both local and export markets. He discussed the demand analysis (traded outputs, prices); production, trading, socio-economic and institutional constraints affecting the resource poor farmers.

SESSION 6

4.6: Storage technologies of Sweetpotato
By Ms Hedwig Natabirwa

Ms Natabirwa discussed the SP storage techniques for both fresh and dried chips. She made highlights on pit stores and clamp storage as the main methods for storage of fresh SP. She explained advantages of drying SP into chips, which permits better preservation, facilitating transport, increased shelf life and creating new opportunities for new markets for farmers. Dried chips of sweetpotato are stored using improved traditional methods, that is, in closely woven baskets, mud-plastered baskets, in brick silos or in metal bins.
The session was followed with a practical training at Kawanda Agricultural Research Institute where participants had hands on experience in the construction of pit and clamp storage structures.

SESSION 7

4.7: Handling Of Fresh Produce For Export
By Lawrence Wafula

The afternoon of day two of the workshop involved a field visit to Flesh handling Ltd, at Entebbe. The company is mainly involved in handling fresh produce like fruits, vegetables and flowers for export.

At Flesh handling Ltd, Mr Lawrence Wafula (Quality Manager), explained the pack house activities before export, which included cooling, sorting, grading and packaging. He emphasized the importance of proper handling after harvest, which he said, impacted on quality of produce. Some of the key challenges noted included the inefficiency of some partners that the company is dealing with. For example, late deliveries of produce, and produce which does not conform to international quality standards. The presentation was followed by a guided tour around the company. Participants witnessed a fresh consignment of sweetpotato arrive. When sampled it was seen to breach the quality standards. This was interesting and trainees were implored to further convince farmers on quality required for export.

SESSION 8

Day three of the workshop involved a field visit to Kawanda Agricultural Research Institute for practicals on storage and processing.

4.8: Processing Aspects Of Sweetpotato

By Ms Constance Owori

Ms Owori underscored the importance of sweetpotato processing. She said that research had identified appropriate processing methods and developed cost-effective technologies for processing SP into value added and less perishable products with market potential. Some of the processing methods included; drying, frying, baking, boiling and heating. She outlined the factors considered for establishing SP processing enterprises as availability of markets, availability and price of fresh SP roots, weather conditions, equipments, working capital, availability and cost of labour. The session was followed with a practical training at Kawanda Agricultural Research Institute where participants had hands on experience in making SP chips and SP snack products (chapatti, crisps, and cakes).

SESSION 9

4.9: Action planning

The participants were divided into three groups of: Extension workers/farmer group leaders, School teachers/lecturers, and Advisors/Quality controllers. The groups were asked to discuss and develop training action plans using the following format:

- Aims of the training
- Expectations of trainees
- Application of the information acquired by trainees on the ground
- The key beneficiaries of the information
- Any expected constraints

The following were the outcomes of the group discussions.

Group 1

Action plan for School teachers/Lecturers

Aims of training

a) To increase output and consumption of sweetpotato in schools and community
b) Mobilize and sensitize schools and community about the nutritional value of sweetpotato

Expectations of trainees

a) School leaders, pupils, expect knowledge and skills in vine acquisition, land preparation, cultivation, storage, processing, marketing both local and foreign
b) Nutritional value of varieties
c) Expect output optimization with minimal input.

Application of the information

a) Trainers on the ground
b) Headmasters/Headmistresses/School leaders will mobilize and sensitize students and teachers.

Target schools

These will be from Mpigi, Luwero and Wakiso districts. Both primary and secondary schools will be targeted as indicated below:

District	**Sub-county**	**Schools**	**Contact person**
Mpigi	Kiringete	St. Johns Muduuma S.S.S	Luyima Jude.
	Muduuna	St. Maria Goretti Katende.	,,
Wakiso	Nabweru	Sam Iga Memorial College	Galiwango Andrew
Luwero	Zirobwe	Zirobwe Church of Uganda	Namubiru Joweria
		Wakatayi S.S.	,,
		Bukimu Islamic.	,,

NB: Overall coordinators and mobilization will be from Buganda Royal Institute of Business and Technical Education (BRIBTE). Contact people will be include Nagawa Harriet, Mpagi Alex and Karombani Kenneth.

Activities will include:

a) Teachers will give talks and two demonstrations
b) Demonstration method will be chapatti making and bagiya chips
c) Making of sweetpotato flour
d) Treating and cutting of vines
e) Making of good mounds
f) Post-harvest handling methods
g) Setting up of demonstration farms (2 demonstration farms)
h) Supervise and follow up projects

The key beneficiaries of the information

These will be:

a) Pupils
b) Parents
c) Community
d) Nation at large

Expected constraints

a) Facilitation
    - Land for demonstration sites
    - Demonstration tools

b) Competition with other products
c) Adaptability to the new techniques

GROUP 2

Action plan for Advisors/Quality controllers

Members were:

1. Kalule J. Bosco, Quality Controller, HORTEXA

2. Mukalazi zakayo, Advisor, HORTEXA

3. Kasedde Godfrey, Administrator, HORTEXA

4. Matovu Moses, Advisor, HORTEXA

5. Joseph Kizito, Advisor, HORTEXA

Aims of the training:

- To train the farmers at the districts so as to have enough food for home consumption first (food security). Emphasis will be put on specific nutritious varieties (i.e. orange fleshed)

- To train beneficiaries about various market requirements (local and international markets).

- To train about the quality maintenance depending on the market requirements (pre- and post-harvest techniques)

- To organize farmers into working groups to enable them penetrate the market to raise their standard of living. The target will be 10 –15 farmer groups

Expectations of the Trainees

(i) Demonstration plots (farms) showing how various varieties can be handled.
(ii) Advisors to go to the grassroot to spread the gospel of production chain i.e. record keeping, pre- and post-harvest handling and storage technique
(iii) Linkage to various exporters so that they gain confidence that their products will have an assured market
(iv) Train them on the various products that can be obtained from sweetpotato and probably marketed locally

Application of the information acquired by trainees on the ground

- The practical aspect is emphasized. Trainees need to be financed and availed with relevant equipments to enable them break the barriers of subsistence farming to commercialized farming (hoes, slashers, tractor services, fertilizers, sprayers, etc)
- Monitoring and evaluation aspects have to be considered at this stage. There is thus need to use motorcycles for inspection purposes.
- There is need to use various communication means at all levels to disseminate the information to the ground i.e. use of TVs, projectors, radio programs, magazines and leaflets, etc.
- Education tours have to be emphasized to enable the farmers to be acquainted to new farming practices and marketing

Key beneficiaries of the information

- **Farmers**: This will improve their welfare and standard of living
- **Exporters**: Accessibility to quality products from various farmers enabling them to compete favorably in the market
- **Government:** Through the high yields and large volumes of export, government will collect enough foreign exchange
- **Schools:** High production will enable schools to get nutritious food i.e. orange fleshed Vitamin A.

Expected constraints

a) **Transport**: Distant areas need the availability of convenience transport facilities
like cars, motorcycles to reach the trainers

b) **Finance:** Trainers need to be facilitated with finance to carry out duties i.e stationery, allowances, remunerations, etc

c) **Infrastructure**: There is need to avail packing and cooling facilities to attain the
required standard to meet the Eure-gap requirements

d) **Communications network:** There is need to maintain the main and feeder
roads to enable the smooth running of the production systems.

e) Lack of finance to fund field visits in different areas.

f) Politicians

Target Districts

i. Mpigi
ii. Masaka
iii. Luwero
iv. Kiboga

Target groups in Mpigi district

i. Mpenja and Kalamba. Contact person is Kalule J.B. Tel: 077 364389

ii. Kibibi. Contact person is Mukalazi Zakayo

iii. Mpigi zone contact person is Kizitu Joseph. Tel: 077 833219

iv. Masaka, Busensero. Contact person is Bakka Isaac

v. Luwero. Kikerege Group and Kikyusa. Contact person is Bakka Isaac. Tel: 071 866872

Each group targets 4-5 farmers.

GROUP 3

Action plan for Farmers Leaders and Extension Officers

Members were:

i. Nabiyina Zaituni Kabuye, Extension Officer. Tel: 077 656120

ii. Nakirigya Unia, Extension Officer. Tel: 077 865975

iii. Sembuze Muhammud, Farmer and Group Leader. Tel. 077 522361

iv. Yiga Beatrice, Farmer Leader. Tel: 077 587404

v. Kabugo Lawrence, Farmer Leader. Tel: 077 542207

vi. Nsamba Danstan, Extension Officer. Tel: 077 883905

vii. Muwanga Kivumbi Erasto, Extension Officer. Tel: 077 884741

viii. Ssetyabula Rajab, Farmer Leader. Tel: 077 883905

ix. Musisi Ronald Junior, Farmer Leader, Mulagi, Kakuto, Kiboga district.

x. Sekiyanja Joeria, Farmer Leader. Tel: 071 878095

Aims:

- Food security
- Improve on their nutrition
- Poverty alleviation

Expectations of trainees

- Mobilization and sensitization of communities and schools
- Identification of farmer groups
- Dissemination of the knowledge and skills acquired from the workshop

- Demonstration on storage and processing practices
- Sharing ideas and experiences with farmers
- To adopt and implement knowledge acquired by the communities trained and schools

Application of the information acquired by the trainees on the ground

- Sensitization of local leaders, teachers, spiritual leaders, etc
- Mobilization of communities at parish level
- Training, demonstration, workshops, study tours
- Supervision

Key beneficiaries of the information

- Farmers
- Teachers plus students/pupils
- Extension staff, CAOs and health workers
- Technical staff at district level
- Businessmen
- Transporters

Expected constraints

- Negative attitudes of local leaders towards the project objectives
- Negative attitudes of the community towards the project
- Facilitation of trainers
- Unreliable weather conditions
- Lack of training materials
- Competition from other crops verses sweetpotato
- Lack of post-harvest equipment
- Lack of access to clean vines
- Possible fluctuation in demand due to change in taste and preferences of foreign markets with time
- Hardships in acquisition of improved vines for those who want
- Lack of acceptability to improved varieties of vines

Code	Activity	Where	When	Who	How
1	Mobilization	- Sub-county level - Parish level	First week October 2003	- Extension workers - Group Leaders - Teachers	- Meetings - Posters - Radios - Televisions - LCs
2	Sensitization	- Sub-county level - Parish level	Second week October	- Extension workers - Group Leaders - Teachers	- Seminars - Workshops
3	Group formation	Parish level	By the end of October 2003	- Extension workers - Group Leaders	Interested participants

4	Vine multiplication	Every LC1	November 2003 December 2003	- Extension workers - Farmers	Rapid multiplication
5	Demonstration	Every LC1	March 2004	- Extension officers - Researchers - LGL - NAARI	- Mounds - Ridges
6	Supervision/ Follow-up	Demonstration sites	March-May 2004	- Extension officers - Researchers - LGL - NAARI	Farm visits
7	Training on CPHP	Demonstration sites	June/July 2004	- Extension officers - Researchers - LGL - NAARI	Constructing post-harvest structures
8	Harvesting	Demonstration sites	June/July 2004	- Extension officers - Researchers - LGL - NAARI	Demonstration on post-harvest storage techniques

5.0: OFFICIAL CLOSING

Mr. Berga Lemaga, Coordinator/PRAPACE, officially closed the workshop. He thanked DFID for sponsoring such an important workshop. He underscored the importance of sweetpotato and its nutritive values and therefore the need to make its production commercial. He told participants that when sweetpotato was compared to maize, the production per hectare was much higher under good management. He therefore urged participants to go back and mobilize farmers to produce substantive amounts of sweetpotato. He said the markets were opening up, and already Maganjo and UGACHIC food processors were willing to buy dry sweetpotato dry chips. For the fresh produce, HORTEXA was undertaking a sea freight shipment study trial which if succeessful would open up export markets since sweetpotato will be shipped in large amounts.

He appealed to the participants to extend the information and knowledge to fellow colleagues and farmers in their districts, and be committed to faithfully execute the workplans developed at the workshop. He appealed to participants to strengthen the linkage established at the workshop and keep one another informed of new developments and also share problems encountered, since they were all partners in development.

He ended by thanking the organizers of the workshop, the facilitators, and staff of PRAPACE for the job well done and the participants for their active involvement throughout the workshop.

The Guest of Honour handed participants Certificates of participation and declared the workshop closed.

6.0 Participants' Impressions Of The Workshop

Participants' impressions were generally positive. They appreciated the whole workshop and the opportunity to share information and experiences on how to deal with the challenges of promoting sweetpotato enterprises. The following are some of the views expressed during the evaluation of the workshop.

1. Paper Presentations/group activities

Following the presentations, the majority of participants (21 out of 23) said that the presentations were effectively delivered in terms of methodology and presentation, were relevant. 16 out of 23 participants also indicated that they liked the way participants worked during the group activity.

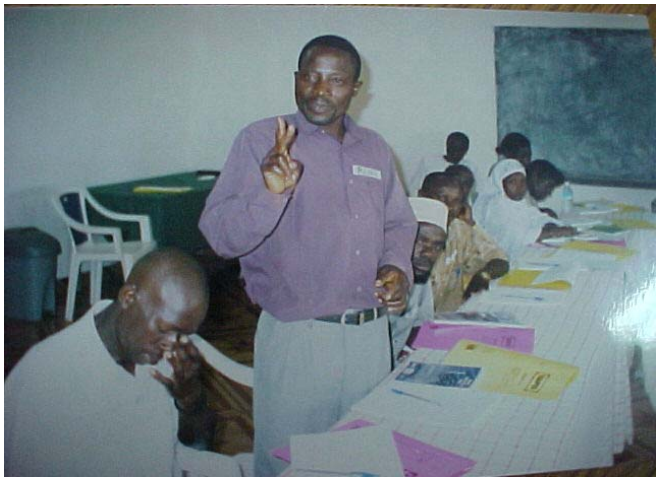
2. Field visit/practicals

The field visit and practicals were found to be very useful and interesting and participants indicated that they had been well organized. The majority (21 out of 23) participants said both the field visit and the practicals were very effective in terms of exposure to new post harvest- handling and processing technologies.

3. General organization of the workshop

By way of general observation, the majority of participants said the workshop was well organized (20 out of 23). Regarding the time allocated to the workshop, 14 out of 23 indicated that the time had been adequate whereas 9 said it was too short. 16 out of 22 participants regarded the venue as appropriate. With regard to the meals, 13 out of 21 found the meals to be good.

Opening Ceremony; Mr Daniel Kisauzi (On extreme right of photograph) Dr. Fina Opio (Centre of photograph) Mr Berga Lemaga (On Extreme left)



One of the brainstorming sessions

Demonstration on how to make clamp storage.

Participants learn to make sweetpotato chips using a sweetpotato chipper

Participants being shown a SP chipper

Demonstration on chipping and drying SP Chips

APPENDIX 1

Training of Trainers on Sweetpotato Post harvest technologies and Marketing
1st – 3rd September 2003, at Hotel Garden, Kampala

Programme of activities

Date	Time	Activity	Responsible person
Sunday 31 Aug 2003	6.00 pm	Arrival of participants Registration of the participants	Mrs. I. Sekitto
INTRODUCTION PROGRAMME			
Monday 1 Sept 2003	8.30am – 9.45 am 9.45 – 10.00 am 10.00 – 10.30 am	Opening Session - Welcome remarks - Introduction of participants - Expectations and Workshop Objectives - Remarks from DFID Regional Office - Official Opening	Mrs. I. Sekitto Dr. Kisauzi Dr. Fina Opio-Director NAARI
	10.30 – 11.00 am	**Tea – Coffee Break**	
SESSION 1			
	11.00 - 11.15am 11.15 – 12.15 pm 12.15 - 1.15 pm	Importance of sweetpotato for economic development Pre-harvest factors that affect post harvest quality of sweetpotato Discussions.	Dr. Robert Mwanga (NAARI) Dr. Robert Mwanga (NAARI) Dr. Robert Mwanga (NAARI)
	1.15 – 2.00 pm	**Lunch Break**	
SESSION 2			
	2.00 – 4.00 pm	Quality aspects of sweetpotato roots for both local and export markets)	Mr. S. Kaggwa (HORTEXA)
	4.00 – 4.30 pm	**Tea – Coffee Break**	
	4.30 – 5.00 pm	Discussions	Mr. Kelly Wanda (FOODNET)
	5.00 – 5. 15 pm	Day's Evaluation	Mrs. I. Sekitto
SESSION 3			
Tuesday 2 Sept 2003	8.30 - 9.15am	Nutritional value of Sweetpotato	Dr. A. Namutebi (MAK-FST)
SESSION 4			
	9.15 – 10.00 am	Post harvest handling of Sweetpotato roots and its products	Dr. A. Namutebi (MAK-FST)

	10.00 – 10.30 am	Discussions	Dr. A. Namutebi (MAK-FST)
	10.30 – 11.00 am	**Tea – Coffee Break**	
	11.00 – 12.30 pm	Marketing of sweetpotato (Challenges and Opportunities	Mr. Kelly Wanda (FOODNET)
	12.30 – 1.00 pm	Discussions	Mr. S. Kaggwa (HORTEXA)
SESSION 5			
	1.00 – 2.00 pm	**Lunch Break**	
	2.00 – 2.45 pm	Storage technologies of sweetpotato	Ms. Hedwig Natabirwa (FOSRI)
	2.45 – 3.00 pm	Discussions	Ms. Hedwig Natabirwa (FOSRI)
	3.00 – 3.30 pm	Travel to Entebbe	
SESSION 6			
	3.30 – 6.00 pm	Handling of fresh produce for export	Mr. Lawrence Wafula (Fresh handling LTD)
	6.00 – 6.15 pm	Day's Evaluation	Mrs. I. Sekitto
Wednesday 3 Sept 2003	8.00 – 8.30 am	Travel to Kawanda Research Station	
	8.30 –9.15 am	Demonstrations on storage technologies of Sweetpotato	Ms. Hedwig Natabirwa (FOSRI)
	9.15 – 9.30 am	Discussions	Ms. Hedwig Natabirwa (FOSRI)
SESSION 7			
	9.30 – 10.00 pm	Processing Aspects of Sweetpotato	Ms. Constance Owori (KARI)
	10.00 – 1.00 pm	Practicals	Ms. Constance Owori (KARI)
	1.00 – 2.00 pm	**Lunch Break**	
	2.00 – 3.00 pm	Practicals Discussions	Ms. Constance Owori (KARI)
	3.00 – 3.30 pm	Travel to Hotel Garden	
	3.30 - 4.15 pm	Action planning	Mr. Silver T (CIP)
	4.15 – 4.30 pm	E valuation of course	All Facilitators
	4.15 – 4.45 pm	Official Closing	Dr. Berga Lamaga
	4.45 – 5.00 pm	**Evening Tea & Departure**	

APPENDIX 2

PRE-HARVEST FACTORS AFFECTING POST-HARVEST QUALITY OF SWEET POTATO STORAGE ROOTS

By Charles S. Niringiye and Robert O.M. Mwanga, National Agricultural Research Organization (NARO),
Namulonge Agricultural and Animal production Research Institute (NAARI),
P. O. Box 7084, Kampala, Uganda.
E-mail: naari@afsat.com

INTRODUCTION

Importance of sweet potato as a food security crop and for income generation

Sweet potato is an important food crop grown and consumed by a majority of Ugandans. Excess produce is also marketed to supplement family income. The crop can be produced under difficult situations, such as low soil fertility and low moisture (water supply), where other crops (except cassava) can fail. It takes relatively short time to reach maturity (3 to 6 months) compared to cassava (12 months or more), meaning that sweet potatoes can be grown twice in a year. Therefore, sweet potato fits well in the food and farming systems, serves well as a food security crop. Storage roots may be eaten boiled or processed into simple products such as chips, local brew/drink, pan-cakes and composite flour (e.g., mixed with maize flour to make porridge). The stems and leaves are normally given as additional feed to livestock. However, in some communities, tender (young) leaves are consumed as a vegetable. Some of the varieties being tested under farmers' conditions are orange-fleshed (like carrots), a sign that they contain vitamin A. Vitamin A is important for building the body's immune system for defense against diseases and blindness.

PRE-HARVEST FACTORS THAT AFFECT POST-HARVEST QUALITY OF SWEET POTATO STORAGE ROOTS:

- Soil (seed bed) type
- Variety
- Health of planting materials
- Time of planting
- Time of weeding
- Soil fertility

Soil (seed bed) type

Sweet potato requires well drained, easy to work soils. The crop can be grown in any soil, but sandy loams give the best yields. Avoid growing the crop in stony soils or waterlogged areas such as clay soils. These conditions do not encourage proper storage root development and expansion. Soil with a lot of stones promotes weevil attack on both vines and storage roots, whereas storage roots rot when the soil contains too much water.

Prepare the seed bed well in advance (at least two weeks) before planting sweet potato, to allow enough time for plant residues to decompose (rot) and release nutrients (food for crops). Deep cultivation improves drainage and the oxygen supply in the soil, which, in turn, favour the growth of bacteria that help in decomposing the organic matter. In addition, deep cultivation is essential for proper storage root development and expansion and best yields.

Sweet potato is grown on mounds and ridges of varying sizes, but rarely on the flat. The mound type of seedbed is the most common, whereas ridges are used in hilly or sloping land to control soil erosion. A mound should be 100 cm (3 ft) wide and 60 cm (2 ft) high; the distance between mounds should be 1 m (3 ft). Ridges should also be 100 cm (3 ft) apart and 60 cm (2 ft) wide. Although the difference in yield between ridge and mound seed bed is small, research has been demonstrated that ridges give much higher income than mounds, simply because making ridges

requires less labour. Ploughing using oxen or tractor is also possible when ridges are chosen. However, mounds are better in flat areas that are infested with mole root rats.

Variety

Varieties differ in terms of dry matter, starchiness/mealiness, sugar content, taste, flavour, fibres, colour of skin and flesh, and resistance to pests and diseases. Sugar content and dry matter affect lignification (wound- healing). Therefore, grow only those varieties that meet market requirements.

Quality of planting material

Select your planting material from a clean, healthy, vigorous looking crop, which is 2 or 3 months old. Vine cuttings from such a crop produce a vigorous crop and better yield, while vines cut from an old crop (4 to 6 months) produce a less vigorous crop and poor yield. This is because as the crop approaches maturity, food stored in stems (vines) is channeled to the enlarging storage roots.

The best planting material is the stem or vine tip, that is, the top 30 cm of the vine, when planting material is abundant. This part most easily recovers from cutting and planting "shock", and it grows faster than the lower parts of the vine. In addition, the tip is more likely to be free of sweet potato weevil and stem borer eggs. The middle parts of the vine may also be used if there is a shortage of planting material. Avoid, as much as possible, the basal (lower) parts of the vine as these may contain eggs, larvae or adult weevils inside. Pests and diseases affect both yield and quality of storage roots.

Time of Planting, methods and plant population

Sweet potato is planted at any convenient time when there is sufficient moisture in the soil to ensure crop establishment. Although the crop is fairly drought tolerant, drought occurring between time of planting and 6 weeks of crop growth reduces yields seriously. Avoid planting late in the growing season as this exposes the crop to drought and weevil damage. Low water availability will result in storage roots that are not marketable, whereas weevil damage reduces both yield and quality of storage roots.

The planting operation involves pushing the lower parts of the vine cuttings into the soil, such that they are nearly horizontal. About 20-cm (8 inch) length of the cutting should lie beneath the soil surface. When mounds are used, three vine cuttings per mound are planted singly in a triangular pattern below the tip of the mound, giving a plant population of about 33,300 plants per ha (or 13,500 plants per acre). If planting is on ridges, single vine cuttings spaced 30 cm (1 ft) apart, are planted in one row along the ridge top, giving the same plant population as the mounds. Low plant population will give very big storage roots, while high population gives many roots that are not marketable.

Weeding

Hand weeding is done two times - the first round at 3 weeks after planting, and the second one at 6 weeks after planting. Late weeding encourages serious competition between the crop and weeds for sunlight, nutrients and water; this leads to low yield.

Remove sick plants as you weed, and re-hill the mounds, thereby sealing any cracks on the surface. Weevils enter through the cracks and damage the storage roots. Re-hilling also minimises exposure of storage roots to sunshine; exposed roots turn green and this lowers their quality.

Soil fertility Maintenance

Soil fertility is the ability of the soil to supply essential plant nutrients in a balanced way. A fertile soil is one that has a loose texture, is rich in nutrients and organic matter (dead plants and animals), a high water-holding capacity, and a high activity of living organisms. A good supply of organic matter and nutrients in such a way that it balances the removal of nutrients through harvesting of crops, is very important to maintain soil fertility. Nutrient loss can be minimised by returning crop residues to the field from where they came.

The following sources of organic matter can be used to enhance soil fertility:

- Farm manure, i.e., the excrements of any kind of livestock, often mixed with left-over of feed. The manure should preferably be ripened for at least 2 weeks before being applied to a crop.
- Compost, i.e., decomposed plant material, for instance, from the kitchen and garden waste, or crop harvest residues.
- Green manure, i.e., a sole crop, or an intercrop that does not compete with the main crop and preferably can fix nitrogen from the air. If grown as an intercrop, the green manure crop should be trimmed regularly after which the cut parts are

left as mulch on the soil surface or incorporated into the soil. If grown in pure stand, the crop is turned under when it has reached the flowering stage.

Harvesting

Early maturing varieties take 4 months while late maturing ones take 6 months from planting to harvesting. Whole sale harvesting (part of or whole garden) is done using a hoe. Make sure you minimise damage to storage roots. Start from the sides of the mound and move progressively towards the centre. Damaged storage roots easily rot or fetch low price on the market. Therefore, select only those roots that do not have cuts or signs of weevil damage.[1] Also, remember that delayed harvesting leads to a reduction in both quantity and quality of storage roots; rotting, sprouting and/or weevil damage increase with time. Varieties that have the ability to heal are least affected by organisms that cause rotting.

[1] Paper presented during Training of trainers in Sweet potato post-harvest technologies and marketing.

[1] Paper presented during Training of trainers in Sweet potato post-harvest technologies and marketing.

QUALITY ASPECTS OF SWEETPOTATO ROOTS FOR BOTH LOCAL AND EXPORT MARKET (PART A) AND

HANDLING OF FRESH PRODUCE (SWEETPOTATO) FOR EXPORT (PART B)

By Simon Kaggwa, HORTEXA

Part A

1.0 Background

The Horticultural Exporters' Association of Uganda was formed in 1990 with a wide range of objectives. The most important being promotion of exports from Uganda. The exports from Uganda to various market destinations include the following: Hot pepper, Okra, Chilies, Apple Bananas, Sugar canes, Matooke and sweetpotato. Sweetpotato constituted the smallest percentage of exports from Uganda to Europe, and a number of factors were responsible for this trend of events.

1. Lack of awareness by farmers and other stakeholders of the market potential of sweetpotato
2. Lack of good varieties of sweetpotato for export in respect to nutritional value and content
3. Poor agronomic practices by farmers.

However, of recent the Horticultural Exporters Association of Uganda in conjunction with DFID has embarked on a wide range of activities aimed at bolstering sweetpotato exports from Uganda.

1.1 Trend of exports (Sweetpotato)

The export of sweetpotato started way back in 1995 with the following export companies taking the lead; Lusaka Growers Limited, Coseda Limited, Sulma Foods and Josen Exporters Limited. During that time (1995-1997) sweetpotato exports from Uganda were used by the above companies to make weight in order to permit them break even.

Of recent the export of sweetpotato has increased and the number of companies participating in export has also increased. The major producing districts have been Mpigi, Luwero, Mubende, Wakiso. The volume of export is expected to rise further if cheaper means of transport of potato to the market is availed.

Below is a figure showing the volume of exports for the last three years.

1.2 Quality aspects for export

This refers to what the consumer wants to know and how the product should be. Quality is not a standard and varies from market to market and from buyer to buyer, what is quality in the Middle East market may not be quality for the ethnic market in U.K.

Quality is a contribution of various attributes, and these include:

1. Variety of product
2. Size of product
3. Shape of product
4. Nutritional content
5. Appearance

- Quality of a product is the key to successful penetration of the market
- The overall objective of quality is consumer safety and satisfaction.

There are many factors that do impact on quality of sweetpotato for export. These include:

1.2.1 Agronomic practices

These are the field or garden operations, they include aspects like the size of mounds, number of vines per mound, harvesting time and interval, disease and pest control techniques

- Size of mound: There is no standard size of mounds, however mounds should be able to permit that the tubers are hidden or are under cover by soil for all the time
- Number of vines – The number of vines per mound determines the size of the tubers, the more the vines per mound the small the size of the tubers and the reverse is true
- For local markets use few vines
- For export markets use many vines.

Harvesting period

During harvest care should be taken to avoid bruising tubers, its recommended that soil removal from the mound start in the sides so as to avoid damaging the tubers.

Pests and diseases

Scouting should be employed to remove pest larvae from the affected field sports to prevent the whole field being attached, the larva should be hand picked and buried. If pesticides are to be used the following must be observed; pre-harvest intervals and maximum residue levels.

1.2.2 Postharvest handling operations

This refers to the activities done after harvesting. These include ferrying sweetpotato and their preparation for shipment.

Note: These activities should be done in away that does not alter the shape, size and color of the sweetpotato

1.3 Quality aspects of sweetpotato for the local market

Unlike the export market, the local market has no specific requirements in respect to quality.

The most important aspects are:

a) Size – Local markets want bigger markets
b) Pest damage/disease – Just like the export market the local market requires tubers free of pest damage

Note: Other aspects like nutritional value, size, shape and color are not important for the local market.

1.4 Quality Aspects in relation to the EUREP-GAP

The EUREP-gap was introduced in 1997 as an initiative of retailers participating in a working group called the Euro-retailer Produce Working Group (Eurep). The objective of the working group is to agree on standards and procedures for the development of the good agricultural practices.

One of the key goals of the Eurep-gap is the improvement of consumer confidence. The most important principle of the Eurep-gap protocol is food safety – there are many factors that do impact negatively on food safety but the most important is crop protection.

In the case of sweetpotato it is advised to use:

a) Only approved pesticides
b) Farmers must have the knowledge required to apply the pesticides
c) Farmers must take all records regarding pesticide used
d) Farmers must dispose off surplus spray mix in an orderly manner.

Note: Farmers in Uganda however, need to be sensitized about the Eurep-gap if sweetpotato exports are to be stopped up.

Handling of fresh produce for export.

There are a wide range of activities done right from field to fork that are very important in respect to quality of sweetpotato destined for export.

These activities are categorized as follows:

1. Selection of good vines
The following types are important for the export market – Kawogo (red), Mbale (yellow), Kyebandula (red), Bwengye, Ejumula and Nasport 1.

2. Field practices – There are many field activities that impact on quality. The following activities should be done:

a) Harvest when soil is moist or wet to avoid bruising
b) After harvesting dip the tubers in water and wash them thoroughly but carefully to avoid bruising skin

3. Pack house activities
In the pack house, the following activities are important

a) Sorting should be done according to color, size and shape
b) The tubers should be allowed to dry under shade
c) The tubers should be packed in cartons and ready for transport to the airport.

Below are the key market requirements for sweetpotato exported from Uganda

- The skin of the tubers should be intact and characteristic of the variety
- No pest/disease damage
- Should be sorted into weights
- Should be relatively uniform in size
- Must not be bruised
- Diameter should be 3-4 inches
- Tubers must not be deformed
- Length 1 feet
- Should be packed dry

- Must be devoid of dust or any other foreign material
- Should be transported at 13°C to avoid color loss.

Nutritional value of sweet potato

By Dr. Agnes Namutebi

Achievements of the session

- *Know the nutritional value of sweet potato roots and its products*
- *Be able to predict the effect of post harvest handling on the nutritional value of sweet potato products*
- ***Nutrients** are substances necessary for maintenance of the normal function of organisms (man inclusive)*
- **Macronutrients** *[carbohydrates, lipids (fats) and proteins]*
- **Micronutrients** *[vitamins and minerals]*
- ***To produce energy***
- ***Regulate body processes***
- ***Keep the body healthy or protect the body***
- *Sugars*
- *Polysaccharides, i.e. starch*
- *Functions of carbohydrates*

— ***Major source of energy***

— ***Essential components of the other nutrients e.g. vitamins***

- — ***Add sweetness, flavor & texture to food***
- — ***Have a sparing effect on proteins***
- — ***Required for normal fat metabolism (manufacture & degradation)***

Fat / lipid in sweet potato

- *Sweet potato is composed of very little / low fat content, i.e. not sufficient to provide energy to the body*

Protein in sweet potato

- *Sufficient amount of protein is found in sweet potato but depends on varieties*

- *On average protein content in sweet potato is comparable to cereals (e.g. maize) but of different quality (i.e. amino acid composition).*
- *Function*
  - ***Source of energy***
  - ***Utilised to build new body tissue and fluids***
  - ***Replaces lost body tissue***
  - ***Produces biochemical components such as antibodies, enzymes & hormones***

Micronutrients in sweetpotato

- *Vitamins*
  - ***Water soluble vitamins (vitamin C)***
  - ***Fat soluble vitamins (vitamin A)***
    - **Beta carotene is a precursor for vitamin A**
    - **E.g. of sweet potato varieties with beta carotene**
      - Ejumula
      - SPK004
      - Naspot 5

- *Minerals*

Composition of dried sweet potato (%)
Major vitamins of sweet potato products (mg per 100 g)
Typical vitamin composition of sweet potato leaves (mg per 100 g)
Effect of post harvest handling on the nutritional quality of sweet potato

- *Reduced moisture through drying out of roots*

  - ***Weight of root is reduced / dry matter content, hence high relative humidity conditions should be maintained during storage of roots***

  - ***For processed products with reduced moisture content, means SP products be appropriately packaged, to prevent entry of moisture***

Effect of post harvest handling on the nutritional quality of sweet potato

- *Effect of high temperature*

  - ***Issue of amylases in sweet potato root***
  - ***Break down of starch in sweet potato***
  - ***Level of sugar in sweet potato root***

Effect of post harvest handling on the nutritional quality of sweet potato

- *Changes in atmospheric composition (i.e. oxygen, carbon dioxide*

  - ***Change respiration pattern of sweet potato during storage, may cause reduction in starch reserves***

Relevance of session to trainees

- *Extension workers*
  - ***Community workers***
  - ***Health / nutrition assistants***
- *Farmer leaders*
- *School teachers*

- ***Agricultural based teachers***
- ***Food & Nutrition teacher***
- *District advisors*
- ***Production coordinators***
- ***Policy makers***

Content of training for beneficiaries at the districts

- *Aims of the training*
- *Expectations of trainees*
- *Application of the informatbion acquired by trainees on the ground*
- *The key beneficiaries of the information*
- *Any expected constraints*

Post harvest handling of Sweet potato root and its products

By Dr. Agnes Namutebi

Achievements of the session

- *Acquire knowledge in handling of sweet potato (SP) roots for the market and food processor*
- *The importance of quality parameters for marketing of sweet potato products*

Sweet potato characteristics

- **Post-harvest period** *begins at the time the Sweet potato (SP) root is harvested up to when the consumer / customer obtains it on the table (plate)*

Maturity status for the market

- ***Maturity****: the stage of development at which the produce has completed its natural growth & is ready for harvest.*

Two types of Maturity status for the market

- Physiologically mature***: stage of maximum development of produce***
- Horticultural maturity***: harvested according to the consumer's requirements***
- **e.g. mature large-sized roots (Ugandan market) Or small-medium sized roots (Foreign market)**

Why are maturity indices important?
Prevent obtaining premature or over mature produce

- ***Prevent loss of consumer confidence***
- ***Enable farmers know whether commodities can be harvested when the market is buoyant***
- ***Enable efficient use of labour & other resources***

Maturity indices should be….

- ***simple***
- ***Non-destructive***
- ***Easy to perform in the field***
- ***Objective (i.e. not subjective)***
- ***Require inexpensive equipment***

Examples of Maturity indices

- ***Appearance [surface morphology, size, colour, shape]***
- ***Compositional factors [total soluble solids, acid content etc.]***
- ***Textural properties***

- ***Flavour***

What are Quality indices?

- *Quality defined as the degree of excellency*
- *Standards required for both sweet potato and its packaging material depend on*
  - ***Client specifications***
  - ***National specifications, e.g. set by Uganda National Bureau of Standards***

Quality indices…

- ***Kinaesthetic factors***
  - ***External texture i.e. smoothness compared to roughness reflects absence of physical defects***
  - ***Internal texture: firmness, fibrousness, juiciness, mealness***

Quality indices…

- ***Appearance***
  - ***Correct stage of maturity***
  - ***Clean, free of any external matter, micro-organisms, pre or postharvest chemicals***
  - ***Uniform size, shape and colour***
  - ***Free of external & internal defects (morphological, physical, physiological, pathological, insect & rodent damage etc.)***

Quality indices…

- ***Nutritional factors***
  - ***Sweet potato should have good concentration of nutrients, which is dependant on maturity***
  - ***Free of toxic factors (fungicides, pesticide residues)***

Postharvest handling of sweet potato

- *Packaging material should not impart*
- **Decay due to excessive moisture retention**
- **Increase susceptibility to decay**
- **Lessen protection from mechanical injuries**
- **Off-flavours & off-odour**

Postharvest handling ….

- *Other considerations*
- **Ventilated cartons are used by horticultural exporters**
- **Wooden boxes should be cushioned but allow for ventilation**

Postharvest handling ….

- *Storage recommendations*

(Sweet potato is perishable therefore still "breathes")

- **Proper storage & display temperatures to avoid sweet potato being under direct sun**
- **Relative humidity: sprinkle with** *clean water* **to cool the roots**

Postharvest handling ….

- **Use of fungicides as required to control senescence & decay**
- **Maintain sanitary conditions in the market**
- **Control pests & rodents**
- **Minimise of handling/ movements during storage**

Quality indices of Sweet potato roots for the food processor

- *Products such as sweet potato flour/ jam / ketchup*
- ***Sound roots, with no bruises***
- ***Low amylase activity***
- ***Proper storage conditions of roots to reduce amylase activity***

Proper packaging

Sweetpotato Marketing in Central Uganda
Issues and Challenges
By Kelly Wanda

Background to the topic

Importance of sweetpotato marketing viewed against the following background:

- *Need outlet for "surplus"*
- *Fight poverty – household income*
- *Catalyst to increased production*
- *Adoption of technologies*
- *Liberalisation ie no price controls*
- *Globalisation & trade*

Aim of the training

Aimed to:

- ***Assist in understanding sweetpotato markets***
- ***Provide marketing skills/innovations/values***
- ***Key interventions that will be needed in order to transform the crop from subsistence to a more commercially oriented sector,***
- ***Identify and develop linkages/partnerships***

Methodology

Participatory approach:
Presentation of issues/challenges
Group discussions
Field visits

Two pronged approach

- ***Demand survey***

– *major markets in prod./ consumption zones*
– *to identify constraints and opportunities for market led research interventions*

- ***Supply survey***

– *to identify constraints along the prod-supply chain through margin analyses*
– *Again determine improved technologies aimed at reducing costs and improving efficiency*
– *to identify market participants*

Overview of Sweetpotato sector

- ***Forms major part of food production system***
- ***Valued for good nutritional properties***
- ***Has multiple uses – food,feed***
- ***Grown by virtually all farmers***
- ***Grown by small-scale/ poor farmers***
- ***Income-generating aspect increasing hence vital for poverty alleviation***

Demand analysis (traded output,prices):
Need to:

- *assess market size, market segments*
- *quality issues*
- *margins and prices to give an indication of competiteveness or profitability*
- *seasonality of price Vs markets*
- *current and future trends*

Market segments
Local:

- *Human food*

- ***fresh form (no value addition)***
- ***secondary processing into products nutri-porridge, cakes etc (value addition)***

- *Animal feed (limited value addition)*

Export:

- *Human food*
  - fresh form

Demand

Local:

Food (fresh form):

- *National annual per capita demand at about 44.5 kgs (traded on the market)*
- *Has been increasing due to pop increase*
- *Price fluctuates due to seasonality in supply*
- *Increasing in urban areas*
- *Preferences – sweet, mealy*

Estimated demand

Region	*Demand (t)*
Central	*362,251*
East	*175,605*
North	*200,001*
West	*309,539*
Total	*1,047,396*

Tonne = 1000 kgs

Local market

Fresh form

- *High price fluctuations*
- *No free entry*
- *Highly perishable*
- *Lack of marketing information*
- *Price takers*
- *High competition many producers and buyers*
- *Lack of standardized weights*
- *Rejects poor quality*

Forces driving demand

- *Increasing population*
- *Increasing urbanisation*
- *Increasing income*
- *Increasing demand from schools*
- *Increasing demand from WFP **
- *Increased competetion*

Secondary processors

- *Low demand (about 1 ton) size still unknown*
- *Low price about*
- *Few buyers and*
- *Currently not there (processed flour)*
- *Fixed price*

Animal feed

- *About 150 tonnes per month*
- *Potential to double*
- *Few buyers*
- *Few sellers (orange fleshed)*
- *Takes all (kachere, poor shape etc)*

Foreign market

- *Price relatively stable*
- *Low volumes*
- *High quality standards – does not take all*
- *Relatively good market information*
- *Fresh form at about 300/= per kg*
- *Incentive for quality ??*

Export market size

Year	***kgs***	***tonnes***	***%increase***
1997	*53,774*	*54*	
1998	*58,545*	*59*	
1999	*89,855*	*90*	
2000	*129,967*	*130*	*58.6*

Production Analysis

- *Fluctuation in volume*

– ***Season***

– ***Declining fertility***

- *Productivity is low*
- *Average about musiri to ½ acre*
- *Low technology input*
- *No economies of scale – individuals*

Production trends

- *Fluctuations due to price fluctuation*
- *Fluctuations due to weather*
- *High cost*
- *Inefficient technology*
- *Lack of production structures*

Production trends 1992-2002 (tonnes)

Year	*Kiboga*	*Luwero*	*Mpigi*	*TOTAL*
1992	*35,214*	*9,568*	*30,722*	*1,904,999*
1993	*36,194*	*9,834*	*31,577*	*1,958,000*
1994	*39,355*	*10,693*	*34,335*	*2,129,001*
1995	*41,093*	*11,165*	*35,851*	*2,223,000*
1996	*28,615*	*775*	*24,965*	*1,548,000*
1997	*35,011*	*9,513*	*30,545*	*1,894,000*
1998	*40,224*	*10,929*	*35,093*	*2,176,000*
1999	*43,514*	*11,823*	*37,964*	*2,354,000*
2000	*44,328*	*12,044*	*38,673*	*2,398,000*
2001	*46,490*	*12,632*	*40,560*	*2,515,000*
2002	*47,914*	*13,019*	*41,802*	*2,592,000*

Other competitors

Year	*Kumi*	*Mbale*	*Soroti*	*Iganga*
2000	*116,323*	*161,286*	*90,982*	*133,007*
2001	*121,999*	*169,156*	*95,421*	*139,496*
2002	*125,734*	*174,335*	*98,343*	*143,767*

Costs of production –new field

Activity	*Cost/acre*	*Cost/kg**	*Cost/kg***
Land prepar	*40,000*	*26.7*	*17.1*
Plough 1	*60,000*	*40.0*	*25.7*
Plough 2	*60,000*	*40.0*	*25.7*
Mounds	*60,000*	*40.0*	*25.7*
Vines	*65,000*	*43.3*	*27.9*
Planting	*20,000*	*13.3*	*8.6*
Weeding 1	*30,000*	*20.0*	*12.9*
TPC	***335,000***	***223.3***	***143.6***

* *yield of 4.5 tons fresh and 1.5 tons of chips*
** *yield of 7 tons of fresh and 2.3 tons of chips*

Cost of prod. – Old field

Activity	*Cost/acre*	*Cost/kg**	*Cost/kg***
Land prepar	*0*	*0.0*	*0.0*
plough 1	*60000*	*40.0*	*25.7*
plough 2	*0*	*0.0*	*0.0*
Mounds	*60000*	*40.0*	*25.7*
Vines	*0*	*0.0*	*0.0*
Planting	*20000*	*13.3*	*8.6*
weeding 1	*30000*	*20.0*	*12.9*
• ***TPC***	***170000***	***113.3***	***72.9***

** yield of 4.5 tons fresh and 1.5 tons of chips*

*** yield of 7 tons of fresh and 2.3 tons of chips*

Processing costs

Activity	*cost*	*fresh*	*Ratio*	*dry*	*cost/kg*
Harvesting	*1000*	*150*	*0.3*	*45*	*22.2*
Transport from farm	*1000*	*150*	*0.3*	*45*	*22.2*
Water	*300*	*600*	*0.3*	*180*	*1.7*
Labor for processing	*200*	*800*	*0.3*	*240*	*0.8*
Fuel (1 litres)	*1770*	*800*	*0.3*	*240*	*7.4*
Pack material	*600*			*100*	*6.0*
Packaging	*200*			*100*	*2.0*
Loading	*200*			*100*	*2.0*
Transport (bag)	*2000*			*100*	*20.0*
Total cost					***84.3***

Margins

Season	***Yield***	***Totalcost***	***Price***	***Margin***
1	***1.5 tons***	***307.7***	***190***	***-117.7***
1	***2.3 tons***	***227.9***		***-37.9***
2	***1.5tons***	***191.0***	***190***	***-1.0***
2	***2.3tons***	***152.9***		***37.1***

If lower ploughing from 60,000/= to 30,000/= per acre

Season	***Yield***	***Totalcost***	***Price***	***Margin***
1	***1.5 tons***	***267.7***	***190***	***-77.7***
1	***2.3 tons***	***202.2***		***-12.0***
2	***1.5tons***	***177.7***	***190***	***12.3***
2	***2.3tons***	***143.3***		***45.7***

If increase price to 270/= per kg of chips

Season	Yield	Totalcost	Price	Margin
1	1.5 tons	267.7	270	-37.7
1	2.3 tons	202.2		42.1
2	1.5tons	177.7	270	72.3
2	2.3tons	143.3		112.8

If vary the following:

- *Land preparation from 40,000 to 35,000/=*
- *Ploughing from 60,000 to 50,000/=*
- *Mounds from 60,000 to 50,000/=*
- *Harvesting from 1000/= to 500/= per bag*
- *Transport from 1000/= to 5 (on farm) per bag*
- *Water from 300 to 180/= per 6 jerricans*
- *Price from 190/= to 170/= per kg of chips*

Margins change as follows:

Trade chain

- *Dynamic*
- *Inter-district*
- *Mostly informal - less understood*
- *Largely competitive*
- *Inefficient ie. exhbits large margin*
- *Mostly carried out by small traders*
- *Reflects the structure of production ie. scattered & small producers*

Trading constraints

- *Poor infrastructure*
- *Insufficient or lack of marketing information*
- *Lack of credit / small traders*
- *High transport costs*
- *Scarcity of supplies*
- *Low contract prices as demand pushes up market prices*
- *Lack of economic values/attitudes*

Production constraints

Include both biotic, abiotic and socio-economic & institutional

Biotic

- *Diseases*
- *pests*

Abiotic (soil fertility,climate & seasonality of production

- ***Soil degradation mainly due to***

– *erosion*
– *over utilization*

Abiotic factors more limiting

Socio-economic & Institutional

- *Low adoption of new technologies*
- *Poor seed distribution*
- *Insufficiency of improved seed*
- *Lack of information on use of improved seed*
- *Lack of sufficient market information*
- *High price fluctuations*
- *High transport costs and other transaction costs*
- *Lack of values/attitudes*
- *Poor institutional support*

SWEET POTATO STORAGE TECHNOLOGIES

Hedwig Natabirwa, National Agricultural Research Organization (NARO), Food Science & Technology Research institute (FOSRI), P.O. Box 7852 Kampala, Tel 041-566844/9

Introduction

Sweet potato is an important crop that fits well in farming and food systems of Uganda. It is a source of carbohydrate in human diet and ranks third among starchy staple crops of Uganda, after cassava and bananas.

Though planting of sweet potato can be done any time of year, when there is sufficient moisture in the soil to enhance establishment, planting is mostly done at the beginning of the rains to produce good yield. The peak-planting season for sweet potato is usually around March/April in most areas of Uganda and peak harvesting occurs from June to September. Sweet potato can be eaten immediately after harvest, stored in fresh form or processed for future use.

Since farmers cannot consume all their produce in the shortest period or market them at good farm gate price, it is common to sell sweet potato at very low price or to leave it in the field. In the field, the root is subject to attack by weevils, diseases, rodents or sprouting and subsequent spoilage, loss of income and food of the farmer. Yet harvested roots are prone to spoilage, enhanced by mechanical damage, physiological changes (respiration, sun scorching, etc), diseases and environmental factors (temperature and relative humidity). The roots lose water to the atmosphere by evaporation, which leads to drying up. Wounded, or cut roots rot and are susceptible to disease. Dried chips too if not properly stored, are subject to weevil infestation, molding and rodent attack.

On the other hand, the situations above can be handled through appropriate storage techniques, which increase the shelf life of sweet potato. This could enable the farmer to increase his income from same quantity of sweet potato or have food for longer duration, and when the farmer needs it most (food security).

Fresh sweet potato storage techniques

Pit storage

Making a pit store

The size of a pit store depends on the amount of sweet potato roots to be stored.
E.g. You can dig a pit of 1m x 1m x 1m for 2 –3 sacks of sweet potato.

- Pits are dug in dry ground away from flood prone areas.
- They are lined with dry grass of at least 10 cm thickness, which protects the roots from damage (acts as a cushion), and also absorbs moisture from the pit. Thus it prevents roots from rotting.
- Sweet potatoes are carefully placed into the pit. They are covered completely with dry grass and then with soil to ground level. This prevents roots from drying out and stops weevils from entering the store.
- Finally the pit is covered with a sloping thatched roof.

i. This keeps it cool by shading it from the sun.
ii. It prevents rain from getting into the pit.

Clamp storage

- A clamp store is made on a raised flat earth surface above the ground level. Locally available materials are used to minimize costs.
- The base of the clamp is covered with dry grass for cushioning and to absorb excess moisture.
- Sweet potato roots are piled on top of the clamp. They are covered with dry grass and soil to seal the clamp. Covering prevents roots from drying out and the weevils from entering.
- The mound is covered with a separate thatched roof to protect it from the sun and rain. A gap is left all around between the roof and the mound for ventilation.

Quality and maintenance of pits and clamps

- Stores must be inspected regularly (every 1 – 2 weeks) for disease, root rotting, rodent damage or insect damage. If any of these problems is found, the whole store must be cleared to discard the affected roots.

- Unaffected roots should be consumed /used immediately to avoid further losses. Unaffected roots from the affected batch should not be stored again.

- Pit stores and clamps can be used in other seasons. All remains of old grass and soil covering should be discarded. Sterilize pits by lighting a fire in them before use.

- Use new dry grass and fresh soil for lining and covering.

Considering the factors that affect storability of sweet potato discussed above, the following should be done:

(i) Select carefully only good quality roots for storage, i.e. do not select insect damaged, diseased, bruised or cut roots.
(ii) Check the stores at regular intervals of 1 -2 weeks for any rots, sprouting, rodent or weevil infestation.
(iii) Handle the roots carefully so that no damage or bruising occurs.
(iv) Shelter the roots from the hot sun, to protect from high temperature.
(v) Maintain the storage environment with appropriate relative humidity, which is not so high to cause rotting, and not low since this would lead to loss of water from the roots and subsequently lead to deterioration. Thus cover the roots with grass and soil.

Storage of dried chips

Drying of sweet potato into chips offers advantages such as,

- Permitting better preservation
- Facilitating transport and increased shelf life
- Creating new opportunities for farmers such as new markets and new sources of income.

Dried chips of sweet potato are stored using improved traditional methods, that is, in closely woven baskets, mud-plastered baskets, in brick silos or in metal bins. Sacks are used as a primary packaging material. The structures are constructed with modifications to prevent insect entry, damage by animals or human theft.

Baskets are plastered with mud to provide protection from rain, strengthen the structure and prevent moisture uptake by dry products. Sacks, baskets and bins must be raised off the ground by means of pallets, large stones or woven poles to prevent moisture absorption. Packed earth (soil) should not be used since this may permit termites and rodents into the store.

Treatment of the chips

Before drying chips or slices are soaked in salted water or in tamarind extract. This protects them against weevil damage during storage.

PROCESSING ASPECTS OF SWEET POTATO

BY Constance Owori KARI

INTRODUCTION

- ☻ Important staple food crop
- ☻ Produced throughout the country
- ☻ Production is on the increase
- ☻ Utilization methods are limited

CHARACTERISTICS OF SWEET POTATO

- ■ *Easy to produce*
- ■ *Perishable*
- ■ *Low market value*

SWEET POTATO PROCESING

☻ *Involves transformation into less perishable, more attractive, more palatable and nutritious products.*

PROCESSING METHODS AND PRODUCTS

■ *Drying*	*Chips, flour*
■ *Frying*	*Crisps, Mandazi, etc.*
■ *Baking*	*Cakes, buns, etc.*
■ *Boiling*	*Porridge.*
■ *Heating*	*Juices*

Factors Considered for Commercial Processing.

- ■ *Availability of markets*
- ■ *Availability and price of fresh roots*
- ■ *Weather conditions*
- ■ *Equipment and other facilities*
- ■ *Labour and other facilities*
- ■ *Working capital*

APPENDIX 3

EVALUATION FORM

FOR THE

TRAINING OF TRAINERS WORKSHOP ON "SWEETPOTATO POST HARVEST TECHNOLOGIES AND MARKETING, AT HOTEL GARDEN, 1 – 3 SEPTEMBER 2003.
FOR

DAY ONE
Participant comments on:
1. Organization of the workshop
   - ❑ Well organized
   - ❑ Adequately organized
   - ❑ Disorganized
   - ❑ Other…….

2. Time allocated for the workshop
- ❑ Adequate
- ❑ More than adequate
- ❑ Too short
- ❑ Other……..

3. Teaching Methodology
   - ❑ More than Effective
   - ❑ Effective
   - ❑ Not Effective
   - ❑ Other……..

4. Presentation of the course by facilitators:

a) Importance of sweetpotato for economic development
   - ❑ More than Effective
   - ❑ Effective
- ❑ Not Effective
- ❑ Other……..

b) Pre-harvest factors that affect post harvest quality of sweetpotato
   - ❑ More than Effective
   - ❑ Effective
- ❑ Not Effective

Other……..

c) Quality Aspects of sweetpotato Roots for both local and Export market
   - More than Effective
   - Effective
- Not Effective
- Other……..

5. Venue
- Most Appropriate
- Appropriate
- Not Appropriate
- Other……..

6. Meals
- Excellent
- Very Good
- Good
- Fair
- Poor

Other……..

EVALUATION FORM

FOR THE

TRAINING OF TRAINERS WORKSHOP ON "SWEETPOTATO POST HARVEST TECHNOLOGIES AND MARKETING, AT HOTEL GARDEN, 1 – 3 SEPTEMBER 2003.
FOR

DAY TWO
Participant comments on:
7. Organization of the workshop
   - ❑ Well organized
   - ❑ Adequately organized
   - ❑ Disorganized
   - ❑ Other…….

8. Time allocated for the workshop
- ❑ Adequate
- ❑ More than adequate
- ❑ Too short
- ❑ Other……..

9. Teaching Methodology
   - ❑ More than Effective
   - ❑ Effective
   - ❑ Not Effective
   - ❑ Other……..

10. Presentation of the course by facilitators:
d) Importance of sweetpotato for economic development
   - ❑ More than Effective
   - ❑ Effective
- ❑ Not Effective
- ❑ Other……..

e) Pre-harvest factors that affect post harvest quality of sweetpotato
   - ❑ More than Effective
   - ❑ Effective
- ❑ Not Effective

Other……..

f) Quality Aspects of sweetpotato Roots for both local and Export market
   - ❑ More than Effective
   - ❑ Effective
- ❑ Not Effective
- ❑ Other……..

11. Venue
- ❑ Most Appropriate
- ❑ Appropriate
- ❑ Not Appropriate
- ❑ Other……..

12. Meals
- ❑ Excellent
- ❑ Very Good
- ❑ Good
- ❑ Fair
- ❑ Poor

Other……..

EVALUATION FORM
FOR

TRAINING OF TRAINERS WORKSHOP ON "SWEETPOTATO POST HARVEST TECHNOLOGIES AND MARKETING, AT HOTEL GARDEN, 1 – 3 SEPTEMBER 2003.

DAY THREE

Participant comments on:

13. Organization of the seminar
    - ❑ Well organized
    - ❑ Adequately organized
    - ❑ Disorganized
    - ❑ Other…….

14. Time allocated for the seminar
- ❑ Adequate
- ❑ More than adequate
- ❑ Too short
- ❑ Other……..

15. Teaching Methodology
    - ❑ More than Effective
    - ❑ Effective
    - ❑ Not Effective
    - ❑ Other……..

16. Presentation of the course by facilitators:

g) Demonstrations on storage technologies of sweetpotato
    - ❑ More than Effective
    - ❑ Effective
- ❑ Not Effective
- ❑ Other……..

h) Processing aspects of sweetpotato
    - ❑ More than Effective
    - ❑ Effective
- ❑ Not Effective

Other……..

i) Practicals on Processing aspects of sweetpotato
   - ❑ More than Effective
   - ❑ Effective
- ❑ Not Effective

Other…….

j) Action planning
   - ❑ More than Effective
   - ❑ Effective
- ❑ Not Effective

Other…….

17. Venue
- ❑ Most Appropriate
- ❑ Appropriate
- ❑ Not Appropriate
- ❑ Other……..

18. Meals
- ❑ Excellent
- ❑ Very Good
- ❑ Good
- ❑ Fair
- ❑ Poor

Other……..

19. Which topics did you find most useful?

……
……
……
……

20. Which topics do you think should have been given more time?

……
……
……
……

21. Which topics do you think should have been given less time?

……
……
……
……

22. List any topics which you think should have been included

……
……
……
……

23. Did you find today's seminar exhaustive in itself or would you recommend a follow-up?
- ❑ Exhaustive
- ❑ Follow Up

24. Do you plan to apply the skills/information gained at this workshop?
- ❑ YES
- ❑ NO

25. If yes, how……
……

26. If no, why not?…….
……..

27. Would you recommend this course to other members of your organization?
- ❑ YES
- ❑ NO

28. Any further comments? Please make them below.
……
……
……
……

APPENDIX 4

LIST OF PARTICIPANTS WHO ATTENDED THE WORKSHOP (1-3 SEPT. 2003)

Name	Institution	Contact Address
1. Kizito Joseph	HORTEXA	P.O. Box 29392, Kampala 077 833219
2. Musisi Ronald Junior,	Farmer, Kiboga	
3. Hajji Sembuuze Muhammud	Farmer, Nkozi, Mpigi	077 522361
4. Setyabula Rajab	Farmer, Luwero	P.O. Box 1239, Zirobwe, Luwero Tel: 077 883905
5. Kabugo Lawrence	Farmer, Luwero	Kalagala Tel: 077 542207
6. Namubiru Joweria	Farmer, Luwero	P.O. Box 1239, Zirobwe, Luwero
7. Nabiyina Zaituni	BUCADEF	P.O. Box 34071, Kampala Tel: 077 656120/271870 Email: bucadef@infocom.co.ug
8. Nakirigya Unia	BUCADEF	P.O. Box 34071, Kampala Tel: 077 865975/271870 Email: bucadef@infocom.co.ug
9. Muwanga Kivumbi	BUCADEF	P.O. Box 34071, Kampala Tel: 077 884741/271870 Email: bucadef@infocom.co.ug
10. Nsamba Danstan	BUCADEF	P.O. Box 34071, Kampala Tel: 077 865975/271870 Email: bucadef@infocom.co.ug
11. Kasedde Godfrey	HORTEXA	P.O. Box 29392, Kampala Tel: 071 454782 Email: kassgo@yahoo.com
12. Mukalazi Zakayo	HORTEXA	P.O. Box 29392, Kampala Tel: 077 833219
13. Matovu Moses	FOSRI, NARO	P.O. Box 7852, Kampala Tel: 077 461322 Email: fosri@imul.com
14. Luyima Jude	BUCADEF	P.O. Box 34071, Kampala Tel: 077 870075/271870 Email: bucadef@infocom.co.ug
15. Kalule J. Bosco	HORTEXA	P.O. Box 29392, Kampala Tel: 077 364389

		Email: kalubo2k@yahoo.co.uk
16. Nagawa Harriet	BRIBTE	P.O. Box 29599, Kampala Tel: 077 643840 Email: hattyus@yahoo.com
17. Karombani Kenneth	BRIBTE	P.O. Box 29599, Kampala Tel: 077 633021
18. Sekiyanja Joeria	Farmer, Luwero	Tel: 071 878095
19. Ssempungu John	BUCADEF	P.O. Box 149, Mityana
20. Galiwango Andrew	Sam Iga Memorial College	P.O. Box 6353, Kampala Tel: 077 507203 Email: galimak@hotmail.com
21. Bakka Isaac	HORTEXA	P.O. Box 29392, Kampala Tel: 071 866872
22. Yiga Beatrice	Farmer, Mukono	P.O. Box 9528, Kampala Tel: 077 587404
23. Mpagi Alex	BRIBTE	P.O. Box 29599, Kampala