

CROP POST HARVEST PROGRAMME

Project Title: Improving the livelihoods of small-scale sweetpotato farmers in Central Uganda through a crop post harvest-based innovation system

R8273 (ZB0342)

PROJECT FINAL REPORT

8 February 2003 – 24 February 2005

Core Partners: Farmers, KARI¹, FOSRI², NAARI³, BRIBTE⁴, EDL⁵, BUCADEF⁶, MAK-FST⁷, HORTEXA⁸, CIP⁹, FOODNET¹⁰ PRAPACE¹¹

Managing Partner: Dr. Berga Lemaga

Managing Partner's Institute: PRAPACE

¹Kawanda Agricultural Research Institute, ²Food Science and Technology Research Institute, ³Namulonge Agricultural and Animal Production Research Institute, ⁴The Buganda Royal Institute of Business and Technology, ⁵Enterprise Development Limited, ⁶Buganda Cultural and Development Foundation, ⁷Makerere University – Department of Food Science and Technology, ⁸Horticultural Exporters' Association of Uganda, ⁹International Potato Center, ¹⁰A Regional Agricultural Research Network focusing on Market-Oriented Research, ¹¹Regional Network for The Improvement of Potato and Sweetpotato in Eastern and Central Africa

TABLE OF CONTENTS

Acknowledgments	iii
Executive summary	iv
1 Background.....	1
2 Identification and design stage.....	1
2.1 Poverty focus.....	1
2.2 Institutional design.....	3
3 Implementation process	5
4 Research Activities.....	8
4.1 Output 1: Rural sweetpotato farmers in Central Uganda linked to local and export markets.	8
4.2 Output 2: Post harvest capacity of rural sweetpotato farmers and processors in Central Uganda enhanced.	15
4.3 Output 3 Sweetpotato based income-generating opportunities created for the resource poor youth and women.....	25
Output 4 Institutional mechanism that empowers poor farmers/rural processors to participate in sweetpotato technology and knowledge innovation systems (TKIS) developed	25
5 Project effectiveness	27
6 Uptake and Impact.....	33
7 Annexes	37
7.1 Annex I: Concept note.....	37
7.2 Annex II: Project Logical Framework.....	38
7.3 Annex III : Projected work plan.....	46
7.4 Annex IV: Summary minutes for coalition and task force meetings held during project implementation.....	47
7.5 Annex V: Mechanisms by which feedback on the process of the project among Partners was maintained.....	51
7.6 Annex VI: Disseminated outputs	52

Acknowledgement

We acknowledge all organizations who contributed in one way or another to the successful implementation of the project.

Special thanks go to DFID for the bulk of the financial support. Acknowledgement also goes to all who made financial contributions in particular to PRAPACE, Horticultural Strategic Intervention Program/NARO and CIP.

Finally thanks to the regional Office DFID for unreserved encouragement, back stopping and to NRI for the technical support.

Executive Summary

The sweetpotato coalition project focused on improving the livelihood of small-scale farmers through the introduction of post harvest technologies, identification of markets and establishment of links as entry points for improving market access. The project purpose was to sustainably reduce post harvest losses, diversify value added products and increase household incomes. The approach used was to promote adoption of research outputs, while developing an innovation system that enhances farmers' access to markets and information. A multidisciplinary team of 12 partners from different organisations implemented the project.

Thirty-seven farmer groups and 17 schools were mobilized and introduced to sweetpotato post harvest handling, storage and processing technologies as well as marketing, entrepreneurial skills and agronomic methods that improve root quality for the market. Twenty-three trainers representing farmers, agricultural extension and teachers were equipped with practical knowledge and skills of sweetpotato post harvest technologies and marketing. The trainers passed on this knowledge to communities and schools in the project and non-project districts. A total of 17,030 project beneficiaries were trained by the extension agents.

Over 20 local market outlets including schools, tertiary institutions, hospitals and NGOs were identified and linked to farmer groups. Farmers responded positively and sold sweetpotatoes but some were disappointed by the lack of timely payments. A database of 300 potential European importers was established. JIMMY PAN IMPEX Ltd-London expressed intent to import about 80 tonnes of sweetpotato per month using sea freight.

A sea freight simulation study in which improved varieties were kept at 14°C and 90% relative humidity for 50 days showed that properly handled and cured sweetpotatoes retained market quality. The roots appeared visually fresh and showed no significant weight loss, rotting or sprouting. African & European panellists said that the sweetpotatoes had acceptable flavour and texture. Sea freighting was estimated to fetch a high profit margin of US \$ 489-2500/ha compared to a profit margin of US \$ 54-1194/ha obtainable from local markets.

On-farm trials for validating storage technologies of fresh sweetpotatoes revealed that pit stores were cheaper to construct than clamp stores, and sweetpotatoes stored in either type for 60-90 days were acceptable for household consumption.

Five rural-based pilot processing centres were established and used as focal points for assessing and demonstrating technologies for processing sweetpotato value-added products. Farmer groups used the pilot centers to produce and market sweetpotato dried chips to urban millers, who utilised it to process sweetpotato composite flour. Sweetpotato snack products and juices were also processed and sold to local markets in the rural communities. Cost benefit analyses of processing technologies and other sweetpotato enterprises generally indicated that they were economically viable.

User-friendly promotion materials such as calendars, posters, sweetpotato training manuals were generated and distributed to farmers and other stakeholders. This enhanced value addition to sweetpotato by the communities. The coalition website (www.sweetpotatocoalition.org) enhanced a wider dissemination of coalition achievements. The coalition is being transformed into an association to ensure sustainability.

1 Background

B.1 Administrative data

NRIL Contract Number: ZB0342	Managing Partner's Institution: PRAPACE
DFID Contract Number: R8273	Partner institution(s): Farmers, KARI, FOSRI, FOODNET, NAARI, BRIBTE, EDL, BUCADEF, MAK-FST, HORTEXA, CIP, PRAPACE
Project Title: Improving the livelihoods of small-scale sweetpotato farmers in Central Uganda through a crop post harvest-based innovation system	Target Institution(s): Farmers, processors, schools, consumers
Research Programme: Crop Post harvest	Start Date: 8 February 2003 End Date: 24 February 2005
Thematic area: Improving access to markets	Budget: £95,034.38

2 Identification and design stage

2.1 Poverty focus

How the project aimed to contribute to poverty reduction, aspects of poverty and the groups targeted

The project identified and worked with the resource poor rural farmers from districts of Mpigi, Luweero, and Kiboga in Central Uganda. Particularly, households with low incomes, the unemployed youth and women, women lacking income generating initiatives were all mobilised and involved into project activities. With these different groups of the rural poor communities, the project worked with the aim of reducing poverty by introducing, evaluating and disseminating different post harvest technologies to reduce sweetpotato losses after harvest and enhance value addition. By establishing active linkages between farmers and markets, farmers increased their incomes through both improved access to markets and better prices from new markets. Entrepreneurial farmers were identified and equipped with knowledge and skills to process dried sweetpotato chips and linked to food factories from which they gained incomes. Women were also equipped with knowledge and skills to make snack and baked products from which they were able to generate some income.

Importance of the livelihood constraint(s) that the project sought to address, how and why this was identified.

Low incomes were the major livelihood constraint identified by the project for intervention. Others were food insecurity, poor nutrition and health, as well as poor post harvest knowledge.

Final evaluation of a DFID funded sweetpotato project (ZA0483) in Central Uganda between 2000 and 2002 indicated that low incomes were a major concern by farmers. The project had empowered farmers to produce sweetpotato through introduction and multiplication of high yielding varieties. This by the end of the project resulted into surplus production that got wasted due to lack of immediate markets and post harvest handling practices. At the same time farmers were unable to meet other basics of life like school and hospital fees. Farmers were not organized into marketing association and lacked adequate institutional support.

How and to what extent the project understood and worked with different groups of end users

The project at the start conducted on-farm and market surveys to establish the status, constraints and opportunities in the production, post harvest handling and marketing of sweetpotato. Based on the results of these studies, the project identified and worked in a participatory manner with different groups of end-users. The first group of end-users was small scale sweetpotato farmers. The project mobilized, sensitized and organized the farmers into thirty seven groups. The lead farmers from these groups were identified and trained on various aspects of post harvest technology and marketing. On-farm trials were conducted with a sample of farmer groups to assess the effects of different varieties and agronomic practices on root attributes required by both local and export markets. A sample of farmer groups also evaluated new sweetpotato storage technologies and their effects on stored root quality. All the farmer groups were involved in the development of user friendly materials including posters, calendars, manuals for dissemination of post harvest technologies.

The second group of end-users was farmer/rural processor groups. These were the farmer groups that expressed interest in getting involved in both sweetpotato production and processing activities. The project identified the groups that were willing and had the potential to process sweetpotato into various products. Participatory demonstration trials were conducted with these groups to select the most suitable equipment for on-farm processing of sweetpotato dried chips. The members selected the sweetpotato products that they preferred for establishing sweetpotato based micro-enterprises.

The third group of end-users was market participants. These included millers, consumers and retailers. Trials were conducted with industrial millers to validate the technical feasibility of sweetpotato composite flour processing. In the same activity, the project determined the effectiveness of yellow-fleshed sweetpotato varieties in producing nutritious sweetpotato composite flour of adequate shelf-life. Consumer information was used to determine the acceptability of sweetpotato composite flour end-products. The project worked with retailers of flour products to test the effectiveness of promotional factors like package, labelling, product price in increasing marketability of sweetpotato flour products.

The fourth group of end-users was schools. The project worked with schools and higher institutions of learning as channels for disseminating sweetpotato post harvest knowledge and technologies and as markets for fresh sweetpotato and its products. The last group of end users was the intermediary organizations such as NGOs, district local councils, parliamentarians. These worked with the project to widely disseminate sweetpotato post harvest knowledge and technologies to rural communities.

Design for adoption of project outputs by the user partners

The project used a number of design elements to enhance adoption of project outputs by end-user partners. First the project established pilot processing centers with farmer and processor groups. The centers were used to demonstrate to end users the technical feasibility of the selected sweetpotato processing and storage technologies. Hands-on skill training on different aspects including sweetpotato product development, enterprise development, etc. was also conducted in these centers. The pilot processing center established with the industrial miller was used to demonstrate to other potential millers that the processing and marketing of sweetpotato composite flour can be successfully integrated under present socio-economic conditions.

Secondly, the project organised training workshops to equip extension partners and farmer leaders with post harvest knowledge and skills. The trained participants were then supported by the project to disseminate the technologies to rural communities. Thirdly, the project established

demonstration structures of post harvest technologies at farm sites and in schools. Pupils and teachers in these schools were then trained to disseminate these technologies in their communities. Lastly, the project developed user friendly posters, calendars, manuals, handouts and a website for dissemination of project outputs to interested stakeholders.

2.2 Institutional design

The process of forming the coalition partnership from the design stage and its evolution during the project

The formation of the coalition partnership was conceived after DFID circulated a call for research proposals in April 2002. BUCADEF and PRAPACE jointly submitted a pre-concept note on the marketing of sweetpotato and livelihood status of small-scale farmers of Central Uganda. Coincidentally a study by BUCADEF as a follow up on a previous DFID-funded CPP project (ZA0483) identified the lack of markets and high post harvest losses as the major problems of the sweetpotato sub-sector in the region. Project ZA0483 on rapid multiplication and dissemination of improved sweetpotato varieties had resulted in the production of surplus sweetpotato that did not show a corresponding increased income for the rural farmers because of limited market access, exploitation by middlemen, and high post harvest losses. The other associated problem was the lack of organization among farmers into viable associations for production and marketing.

A review of the concept note by the Crop Post Harvest Programme Advisory Committee in August 2002 revealed that the proposed project required a multidisciplinary team from the private and public sector to effectively implement the project on a partnership basis. PRAPACE then identified institutions that were already doing various activities on sweetpotato. The following became the core partners of the coalition: farmers, CIP, KARI, FOSRI, NAARI, MAK-FST², BRIBTE, BUCADEF, HORTEXA, Maganjo Grain Millers, TONNET Enterprises, FOODNET, and PRAPACE

Partners together identified project objectives, outputs, activities, roles of each partner and decided on budget allocation. The project started with a total of eleven partners, who elected PRAPACE as the Managing Partner, based on individual assessments by partners. Enterprise Development Limited (EDL) joined the partnership during implementation stage of the project to foster training of farmers in entrepreneurial skills, and work with BRIBTE to implement project activities in schools. Other interested groups such as Ssemwanga Group, Uganda Marketing Services, Uganda Biodiversity Network and farmer groups from Mubende and Mukono districts who expressed interest in the sweetpotato coalition, worked with the coalition as external stakeholders.

Institutional hypothesis

The livelihoods of the sweetpotato communities of Central Uganda can be improved by bringing together researchers, farmers, extension and the private sector to work towards a common goal of reducing post harvest losses, value-adding and increasing market access.

Other institutional factors that were seen as being important were:

- the need to mobilise and strengthen farmer groups through training on various aspects of sweetpotato post harvest
- link farmers to other stakeholders, credit institutions and markets to empower them to boost their negotiating skills

² MAK-FST partner joined at the stage of preparing the project memorandum.

- use of schools as channels for dissemination of sweetpotato post harvest technologies

3 Implementation process

How participation was maintained among the different stakeholders (the Managing Partner and the Core other Partners and, where relevant, user communities) in the research process

The partnership was organised in such a way that it used a participatory approach to conduct activities on adaptive research/training and to select and adopt technologies.

The project was managed by PRAPACE, with the assistance of a project field officer, who coordinated the day-to-day activities. Respective partners performed project activities as originally agreed upon at the start of the project. Also agreed upon was that in cases where more than one partner was needed to accomplish an activity, a sub group of 2-3 partners guided by a lead partner, carry-out sub-activities and budgets be reallocated to facilitate execution of the sub-activities.

The core partners were involved in planning and design of the project. During implementation, key end-users participated in raw-material collection, participatory demonstration, attendance of workshops and meetings, trials, selection of technologies and field visits. Lead farmers played key role in mobilizing fellow farmers for project activities.

In addition, other mechanisms were put in place for the project partners to link with one another. General partnership meetings/workshops and Urgent/adhoc meetings were scheduled and held from time to time to review progress of activities, plan and give advice where necessary. Letters, phones, and emails were the main means of communication to partners. A coalition website was also developed. Farmers/beneficiaries were easily accessed by mobile phones and/ or communication through BUCADEF extension workers.

Strengths and weaknesses of the monitoring system, and how the information provided by the monitoring system was used

The project had a monitoring and evaluation (M&E) system which helped to track the progress of activities against work plans, specific implementation problems and mitigation measures, progress in generating outputs, outcomes of actions taken and activities implemented. The M&E was done at two levels: at the management level by the project implementation team and at the beneficiary level by the targeted groups with assistance of independent beneficiary M&E facilitators who guided discussions in the quarterly meetings. Dissemination of M&E results / findings was done through quarterly meetings. Getting feedback from the farmers enabled the partners to learn of their successes, failures & progresses, and hence made adjustments to the respective methodologies. Coalition activities not accomplished by assigned partners were reallocated to other partners to ensure that outputs were achieved. Also, during meetings partners used to encourage those who had not accomplished their activities to be more effective.

As a requirement partners gave farmers their work plans at the beginning of every quarter, so that beneficiaries were aware of their expectations. However, the major weakness was late submission of work plans by some of the partners despite continuous reminders.

Major changes that took place during the implementation period, why they came about and how the project managed them

Some changes took place during the implementation period. First there was change of personnel in some partner institutions who were already familiar with the project. This was due to reshuffle of staff in partner institutions. The project sensitised the new personnel but also capitalised on trained farmer leaders and other trainees to implement the activities.

There was change in status for some partners. MAGANJO and TONNET changed status from being core partners to Private Sector stakeholders. MAGANJO was regarded as a market and TONNET a fabricator.

There was change of roles. Lead partners for some project activities could not deliver as expected and were therefore assisted. BUCADEF's role in training other farmer groups was assisted by research partners and the trained trainers. HORTEXA's role in identifying markets for export and linking farmers to export markets was boosted by PRAPACE. The schools activities by BRIBTE and building entrepreneurial skills among farmers by BUCADEF were boosted by EDL.

Prioritization of activities and reallocation of funds was found important since the project had limited funds. FOODNET had been allocated limited funds for specific activities. However, as the project progressed FOODNET was assigned more roles, hence more funds were allocated. Funds meant for the actual shipment trial of sweetpotato were reallocated to conducting a cost benefit analysis of post harvest technologies. The shipment trial required large sums of money and could not be undertaken.

A list of organisations involved, directly or indirectly, in the project and their relationships and contributions.

All core partner organizations were involved in the project activities up to the end of the project. Their relationships and contributions were as described in Table 1 below.

Table 1 Organizations involved in the sweetpotato coalition project

Category	Nature of involvement	Relationships / contribution
National Research Institutions (KARI, FOSRI, NAARI, MAK-FST)	Direct	<ul style="list-style-type: none"> • Provided post harvest knowledge, technologies and information to farmers, potential rural processors, extension agents and schools. • Exchanged and shared knowledge and information among research institutions, regional networks and CIP
Farmers and Rural processors	Direct	<ul style="list-style-type: none"> • Key beneficiaries of post harvest knowledge and technologies; added value to sweetpotato and accessed markets • Shared ideas and experiences with other project partners and gave feedback • Participated in selecting technologies with researchers and extension agents
Schools (BRIBTE, EDL)	Direct	<ul style="list-style-type: none"> • Obtained post harvest knowledge and passed it onto farmers and schools. • Trained farmer groups in business and entrepreneurial skills (EDL)
Extension service organisations (BUCADEF, HORTEXA)	Direct	<ul style="list-style-type: none"> • Extension agents got trained on post harvest knowledge and technologies and delivered knowledge to farmers and rural processors
Regional Networks (PRAPACE, FOODNET)	Direct	<ul style="list-style-type: none"> • Collaboratively linked with all partners, through coordination and provided market information

		<ul style="list-style-type: none"> Supported BUCADEF and HORTEXA to establish market linkages for farmers and provided technical backstopping
International Potato Center (CIP)	Direct	<ul style="list-style-type: none"> Shared knowledge and information on post harvest technologies with research institutions to provide technical backstopping and availed post harvest technologies to farmers and rural processors
External stakeholders - NGOs - District Local Council leaders - Service providers - Private sector	Indirect	<ul style="list-style-type: none"> Provided expertise to partners, influenced and mobilised farmers, offered communication services, and assisted in wider dissemination of technologies and market promotion of sweetpotato

Changes to the coalition (joining/leaving) during the project

EDL joined as a new partner in the first quarter of 2003/4 to work with BRIBTE to disseminate post harvest technologies in schools. EDL had rich experience in enterprise development and had been working with schools and therefore was found vital for the partnership. Other organizations and private sector companies including VEDCO, World Vision, Ssemwanga Group, Uganda Marketing Services and Lusaka growers joined later as external stakeholders.

How will (have) project outputs affect(ed) the institutional setting?

- Farmers were mobilised into groups: This enhanced group marketing, group enterprises and support negotiation.
- There has been change of attitude and improved relationships among farmers.
- New collaborative linkages have been established and networking improved between technocrats, researchers, service providers and beneficiaries.
- Partnerships provide room for sharing experiences and learning from one another.
- Researcher-Extension workers-farmers linkages were strengthened.
- Farmers' and extension agents' knowledge capacity and skills have been enhanced. Knowledge sharing through farmer-to-farmer extension approach has improved.
- Farmer links to markets increased farmers' income.
- There is improved access to information for farmers which will enable them respond to market needs.
- The coalition is transforming into an association to further support the resource poor rural farmers.

4 Research Activities

This section gives a description of all research activities conducted to achieve the outputs of the project.

4.1 Output 1: Rural sweetpotato farmers in Central Uganda linked to local and export markets.

Title of activity: Analysis of input markets.

Findings of the test marketing activity of sweetpotato composite flour indicated that processing and marketing of sweetpotato composite flour could advance to the commercial phase. However, in order to reach commercial processing targets, adequate supply of quality raw material (i.e. dried sweetpotato chips) is necessary to ensure that product supply and demand grow at the same pace. A market input analysis was carried out in the three project districts with the aim of selecting target areas for processing sweetpotato into dried chips. The objectives of the study were:

1. Identify farmer groups interested in participating in the processing of sweetpotato dried chips
2. Study competing markets to ensure that the price offered for dried chips gives rural processors sufficient incentive to process and sell dried chips.

A checklist was designed and administered to 13 farmer groups that existed in the project area at the time of the study with six in Luweero district, four in Mpigi and three in Kiboga. Information on sweetpotato production, processing and marketing was collected. The following issues were in particular analysed:

- Availability of sufficient production of yellow and orange-fleshed sweetpotato varieties to justify establishment of processing facilities
- Seasonal variation in production of sweetpotato
- Suitability of prices of fresh roots to permit dried chips processing
- The status of sweetpotato dried chips processing in the project area
- If the dry season coincided with harvest times
- Existing sweetpotato marketing arrangements and constraints faced by producers
- Interest and willingness to engage in commercial processing
- Changes required to enable establishment of commercial dried chips processing.

Results of the study revealed that production of sweetpotato by 70% of the surveyed groups was aimed at meeting subsistence needs. Average land holding per household was 0.75 acres. Most farmers (80%) grew local white-fleshed varieties. Only 20 % of the farmers grew the improved yellow and orange-fleshed varieties (Fig. 1). The main reason cited for low production of the varieties required by the processing market was lack of financial support to buy vines. The most popular improved sweetpotato varieties were *NASPOT 1* (yellow-fleshed), *Kakamega* (pale orange-fleshed) and *Ejumula* (orange fleshed). Most of the farmer groups in Mpigi district grew the yellow-fleshed variety for local and export markets. In Luweero, a few group members had *Kakamega* and *Ejumula* varieties. Only a few farmers in Kiboga had the improved varieties (*NASPOT 1*). Respondents reported that the main planting seasons were between April to June and September to November. Harvest times were reported to coincide with the dry season.

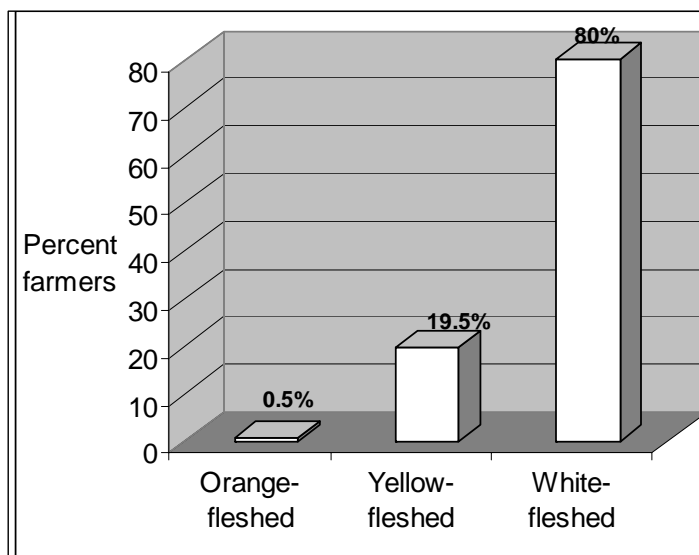


Fig. 1 Percentage of farmers growing yellow, orange and white-fleshed sweetpotatoes in project target districts

With the exception of two farmer groups in Luweero, respondents indicated that they did not have any experience with dried chips processing and they had no knowledge of the processing technologies. Willingness and interest to engage in commercial processing varied widely among the groups. The farmer groups in Mpigi district and areas in Luweero located near the city were unwilling to engage in processing activities as they indicated that they had good local and export markets and get good prices US \$ 0.20-0.22 (Ug shs 350-400) per kg of fresh roots. The farmer groups in Kiboga and parts of Luweero district located far from the city were most willing to engage in processing activities because they did not have markets for their fresh roots. Prices of fresh roots in these areas were 75%-88% lower than those obtained by farmers Mpigi district.

Based on the results of the study, Kiboga district was identified as the area with the greatest potential to process sweetpotato into dried chips. Areas in Luweero situated far from the city were also considered as suitable for dried chips production. Prices of fresh roots in these areas were considered low enough to permit dried chips processing. A total of four farmer groups, two in Kiboga district (*Kinakulya Kakuuto* and *Nakitembe* farmer's groups) and two in Luweero (*Tusitukirewamu* and *Kukolanyo Kulyannyo* farmer's groups) were identified as interested in dried chips processing. In order to have sufficient raw material for processing, it was suggested to these groups to change their sweetpotato production system by growing more of the yellow and orange-fleshed sweetpotato varieties on a commercial basis.

Title of activity: Survey of industrial markets

A survey of privately owned urban flour milling industries located within Kampala municipality was conducted with the aim of identifying markets for sweetpotato dried chips, a primary processed product targeted by rural processors. The objectives of the study were:

1. assess millers' knowledge/awareness about the utilisation of processed sweetpotato in food products.
2. identify millers that were willing and had the potential to incorporate processed sweetpotato in their products.
3. identify the products with sweetpotato as an ingredient
4. determine the price that millers were willing to pay for dried chips.

Twenty urban flour millers were identified, however, only nine were willing to discuss sweetpotato product development and to be interviewed. A semi-structured questionnaire was used to interview respondents. Information collected from the respondents included : miller's knowledge about the utilisation of sweetpotato in processing value added flour products, types of flour products processed and their end-use, prices of raw materials, prices of flour products, places where the flour products are sold and problems faced in the processing and marketing processed products. Comparisons of price patterns of raw materials that respondents used to process flour was made a basis to provide a favourable price for sweetpotato dried chips.

Survey results showed that all respondents were not aware of and had no knowledge about the utilisation of sweetpotato flour in food products. The main flour product products processed by respondents were maize flour (88.9%), millet flour (55.6%) and cassava-millet composite flour (11%). The major end use of the flours were reported as for preparation of thick and thin porridge. Respondents reported that price of raw materials ranged between US \$ 1.23–0.21 (Ug Shs 220-360)/kg for maize, 0.07-0.26 (125-450)/kg for millet and 0.07-0.2 (125-350) for cassava. End product prices ranged between US \$ 0.23-0.34 (Ug Shs 400-600)/Kg for maize flour US \$ 0.24-0.35 (Ug Shs 420-620)/Kg for millet flour and US \$ 0.45 (Ug Shs 800)/Kg for the composite flour. The majority of respondents sold their flour product to retail shops (77.8%) and schools (44.4 %) within Kampala. The major processing and marketing problems faced by the milling enterprises as reported by respondents were high electricity rates leading to high processing costs (77.8%) power instabilities leading to delays in processing (66.7%), raw material price fluctuations (22.2%) and inadequate storage space (22.2%). Based on the price comparison and nutritional value of raw materials used to process different flour products, it was suggested that processors pay US \$ 0.29 (Ug Shs 500)/Kg for high quality dried chips.

Out of the nine milling enterprises interviewed, four were willing to try incorporating sweetpotato flour into their flour products. Only one milling enterprise (*Kasawo Grain Millers*) promised to pay the suggested price of US \$ 0.29 (Ug Shs 500)/kg for dried chips. The poor image and low status of sweetpotato was the main reason for the reluctance of the other millers to use dried chips in their products. Based on the results of the study, it was concluded that although industrial markets are potential markets for sweetpotato dried chips, it is very difficult in the initial stages to penetrate these markets with new products.

Title of activity: Feasibility and acceptability of sweetpotato composite flour products

Previous research conducted by Kawanda Research Institute identified combinations of sweetpotato dried chips, maize and soya that could be used to process sweetpotato composite flour of high nutritional value to produce porridge. The best composite flour product contained 30% sweetpotato flour. Orange sweetpotato varieties (*Kakamega* and *Ejumula*) with high beta-carotene content were used in the prototype mixtures to produce composite flours rich in Vitamin A. This research output provided a market opportunity for farmers producing orange fleshed sweetpotato varieties. The baseline study conducted in the project area however revealed that most farmers grew local white-fleshed sweetpotato varieties that do not have beta-carotene. Only 0.5% of the farmers produced orange-fleshed varieties while 19.5% grew yellow-fleshed sweetpotato varieties that have moderate levels of beta-carotene. In order to secure market opportunities for the farmers producing yellow-fleshed sweetpotato varieties, processing trials of sweetpotato composite flour using sweetpotato from a yellow-fleshed variety *NASPOT 1*, was conducted on a pilot scale. The aim of the research was to determine whether yellow-fleshed sweetpotato varieties could be used to produce acceptable and value added sweetpotato composite flour products. The objectives of the study were to:

1. compare the nutritional data of sweetpotato composite flour processed using yellow and orange-fleshed sweetpotato varieties with the flour processed from maize (control)
2. establish the shelf life of prototype sweetpotato flour products
3. determine consumer acceptability of sweetpotato flour end products incorporating the yellow-fleshed variety.

Processing trials were conducted with the milling industries that were willing to incorporate sweetpotato flour in their products. Samples of the sweetpotato composite flours were analysed for various nutrients including vitamin A, proteins and total sugar. Nutritional data obtained was compared with that of maize flour (control). A shelf life study of sweetpotato composite flours was conducted. Twenty gram samples were packaged and sealed in polypyrone material and stored in a clean laboratory cabinet at ambient conditions (23-27°C). Moisture content, reducing sugar content, yeast and mould counts were the parameters of the flours monitored on a monthly basis for six months. Acceptability of sweetpotato composite flour end products (porridge) was determined by conducting acceptability tests with consumer panellists. The products were presented to 160 consumer panellists for comparison with maize flour porridge (control). Acceptability of various product characteristics were rated using a score of 1-5 (1 = not acceptable and 5 = very acceptable).

Nutrient levels of sweetpotato composite flours processed using the yellow-fleshed (*NASPO T 1*) and orange-fleshed (*Ejumula*) sweetpotato varieties were comparable. However, it is known that orange-fleshed varieties have much more beta-carotene than the yellow-fleshed varieties, hence higher vitamin A contents, which was contrary to this study. The maize flour (control) had significantly lower nutrient levels than the sweetpotato composite flours (Fig 2 a and b).

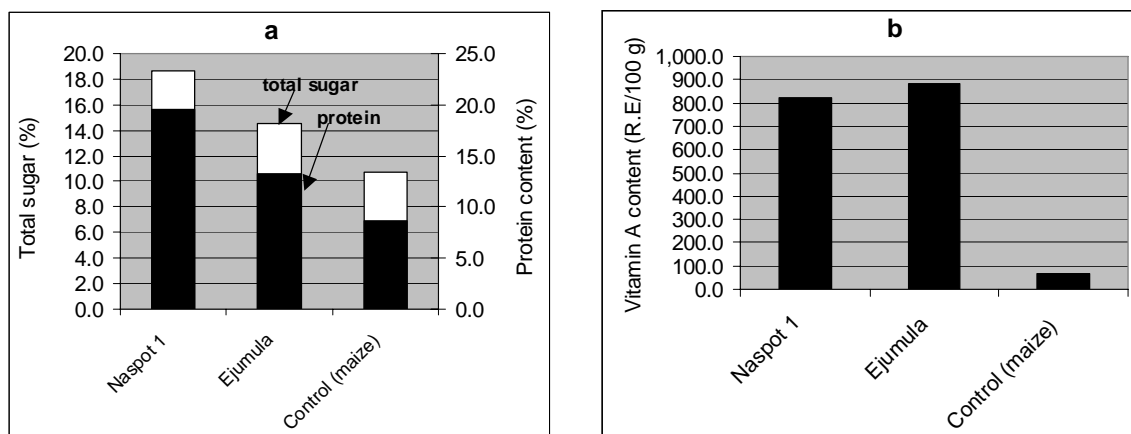


Fig. 2 Protein, total sugar (a) and vitamin A (b) contents of sweetpotato composite flours

Results of the shelf life experiment showed a gradual increase in the moisture and reducing sugar content of the sweetpotato composite flour peaking at the fourth month of storage. Then moisture content did not increase beyond 12%. Since the yeast and mould count levels were negligible throughout the six months storage period, it is possible for the flours to be stored at ambient for six months provided the packaging and storage conditions do not allow moisture adsorption by the flours. Consumer acceptability results showed no significant difference in the overall acceptability rating of sweetpotato porridges (4.1) and the control porridge (4.6).

The results of this study demonstrated the feasibility and effectiveness of yellow-fleshed sweetpotato varieties in producing sweetpotato composite flour with adequate shelf life and acceptable end products. However, it is recommended that further analysis of the nutrient levels of the composite flours and effects of drying on beta-carotene content of the yellow and orange-fleshed varieties be validated.

Title of activity: Market testing of sweetpotato composite flour

To guarantee success of sweetpotato composite flour in consumer markets, it was found necessary to introduce the product in a test market before commercialising it. Test marketing of sweetpotato composite flour was therefore undertaken with the aim of testing the effectiveness of low cost promotional activities in promoting new products. The objectives of the study were to:

1. test the efficiency of retail shops in distributing new products
2. test the effectiveness of simple labelled packages and attractive prices in promoting new sweetpotato products.

The shops situated in low and high income areas where the four millers who participated in the processing usually sell their flours, were identified as suitable test markets. Samples of sweetpotato composite flour were packed in 0.5 and 1 kg sealed translucent polythene packages. The packages were labelled with brand name “nutritious porridge flour”. Information on the product’s ingredients, its nutritional value, preparation methods and expiry date were provided on the package. A consensus was reached that the products be sold at an attractive promotional price of US \$ 0.56 per kg. Enough inventory to meet the demands of the initial small market was distributed to the test market. A data collection sheet was developed to obtain on a weekly basis feedback on the products performance on the market. Data collected included amount of product sold by shop, type of consumers who purchased product and rate of repeated purchases compared with initial purchases.

Although the product was distributed to four milling industries, feed back on the product demand was only from one miller (Kasawo Grain Millers) who sold the product samples. The other three millers indicated that they distributed the product as free samples to their customers. Kasawo grain millers reported that they were able to sell five kg of the product in the first week in the retail shops. The major consumers were middle-income mothers who indicated that they liked the product because of its unique characteristics of:

- desirable taste
- satisfying/filling characteristic
- less sugar requirements
- nutritious product
- increased milk production for lactating mothers

Repeated purchases of the product were high in the following week. The demand for the product increased but the miller was unable to meet the demand due to limited supplies of the product. Information on product demand was therefore not adequately collected due to limited supplies of the product and limited time.

Results of this study showed that the low cost labelled flour packages and the product price were effective market penetrative mechanisms. The retail shops are also an effective distribution system. It is therefore concluded that the marketing of sweetpotato composite flour can be successfully integrated under typical socio – economic conditions to increase income of sweetpotato farmers/rural processors and private sector enterprises.

Title of activity: Sweetpotato coalition data base of market linkages

The coalition identified over 20 local markets (schools, universities, hospitals) and export market (European countries) with their respective characteristics (required sweetpotato varieties and their respective root shape and size) and compiled as an electronic database (CD).

Title of activity: Sea freight simulation of fresh sweetpotato roots

The demand for sweetpotato fresh roots on the European niche markets is still high and this market cannot be quenched by the Caribbeans, who currently are the main suppliers via sea. Sweetpotato from Uganda is air freighted at extremely high costs considering that sweetpotato is categorised as a low value export crop, and usually included as filler when exporting high value crops. On this ground, a sea shipment simulation study was conducted to:

1. determine the morphological and physiological changes of dehaulmed and cured sweetpotato so as to recommend this technique to farmers involved in the export of the crop
2. determine acceptability of sweetpotato under sea freight conditions by two categories of consumers (African & European panellists)
3. determine the losses in sweetpotato root weights, dry matter and beta-carotene contents of the roots
4. estimate the sea freight profit margin of sweetpotato from Uganda

Eighteen metric tons of sweetpotato, procured from HORTEXA and BUCADEF farmers, were dehaulmed (cutting of foliage) and cured at ambient conditions for 3 days under farmers' home shades. The roots were packaged in 10 kg waxed cartons, stacked in a refrigerated freight container, and maintained at 14°C and 90% relative humidity for 50 days. Sweetpotato varieties used were yellow to orange fleshed varieties (*Kakamega* or *SPK004*, *Ejumula*, *Kala*) and the off-white to white-fleshed varieties (*NASPOT 1*, *NASPOT 2*, *#93/29*, *Kasujja*, *New Kawogo*, *Nakakande* and *Jowelia*). *Kakamega* variety stored best and showed no significant weight loss, rotting or sprouting. Varieties that were dehaulmed and cured showed low levels of weight loss and soft rotting, caused by *Pythium*. While sweetpotato that had not been dehaulmed and cured showed three types of rotting restricted to the tips of the root. *Ejumula* variety deteriorated the most compared to all the varieties that were investigated, while variety *#93/29* was the only one that sprouted. Variety *#93/29* produced considerable amounts of latex and showed no damage on the tips. This was attributed possibly to a better healing phenomenon compared to other varieties that hardly exuded latex. Generally dehaulming and curing tremendously improved sweetpotato quality.

After 50 days acceptability tests showed that the African panellists ranked the steamed (cooked) sweetpotato as fair to good while the European panellists rated it as good to very good.

Initial beta-carotene content was highest for *Ejumula* variety (4.8-8 mg/100 g) followed by *Kakamega*, also referred to as *SPK004* (4.5-5.5 mg/100 g) and *Kala* (<1.0 mg/100 g) on a dry solids basis. Dry matter, weight of roots and beta-carotene content percent losses depended on the sweetpotato variety and individual roots within a variety from different farmers who participated in the study (Figs 3 and 4). Root weight loss was not more than 12%. Beta-carotene percent losses were quite high for specific roots, but of the three varieties tested, *Kakamega* variety showed the lowest beta-carotene percent loss (< 20%). Variations in the dry matter contents of sweetpotato were noted which did not correspond to changes in mean root weights. The negative percent change in dry matter of most sweetpotato (Fig 4) suggested that the roots had desiccated or lost moisture.

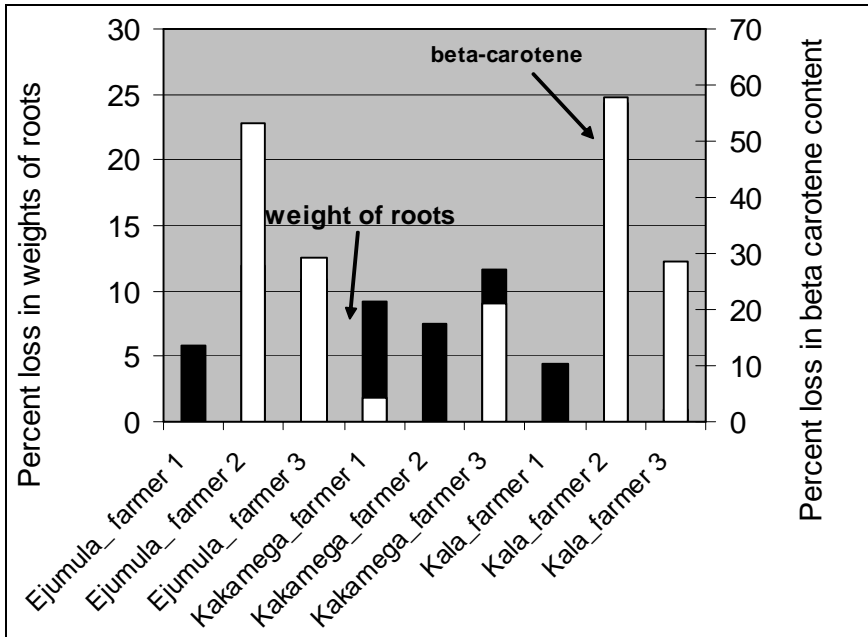


Fig 3. Percent losses in weight of roots and beta-carotene of yellow and orange fleshed sweetpotato from different farmers of Luweero district

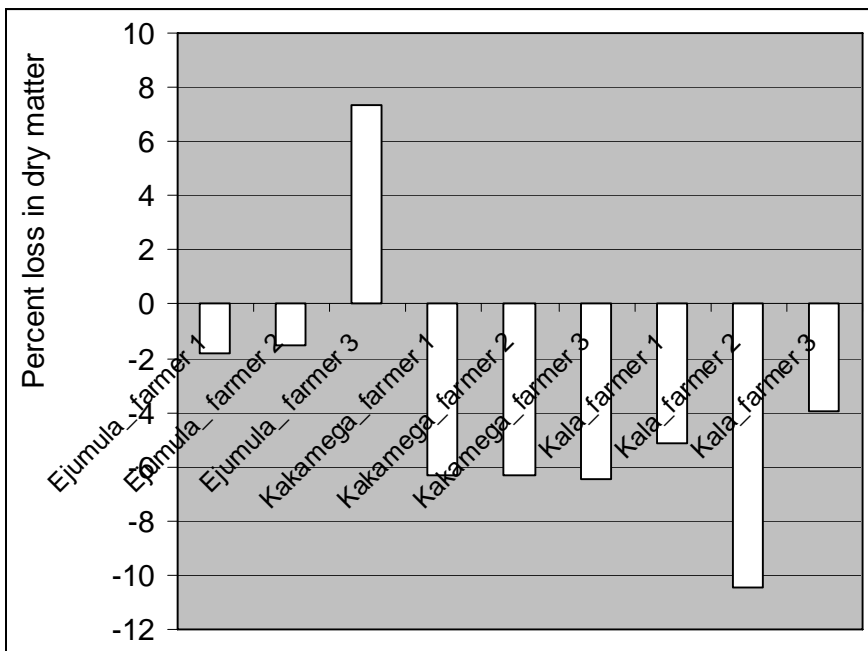


Fig 4. Percent change in dry matter content of yellow and orange-fleshed sweetpotato from different farmers of Luweero district

It was estimated that the returns for a farmer producing sweetpotato roots for the export market is US\$ 489-2500 per ha of the improved varieties, much higher than for the domestic market which has a return of about US\$ 54 -1194 per ha. Sea freighting sweetpotato roots was estimated to fetch US\$ 394-6,902 probably, if sold at a competitive price of US\$ 1.01 per kg. However, this would require the exporter to sell at US\$ 2.25 per kg in order to earn US\$ 1,612-8,523. The study indicated that export of sweetpotato roots by sea is technically and economically feasible, and required a further study to validate dehauling and curing as a technique for handling sweetpotato for the export, physicochemical changes of the roots.

Title of activity: Validating the effects of dehaulming and curing on the quality of sweetpotato roots

Curing is a recommended pre-storage treatment for prolonging the shelf life of harvested crops and thus reducing post harvest losses. The treatment has been tested on sweetpotato in Tanzania and elsewhere in the world, whereby farmers and researchers reported improved quality of sweetpotato roots through hardening of the skin by lignification and wound healing. Following the sea freight simulation study, it was found that dehaulming and curing greatly improved the quality of sweetpotato. The objective of the study was to determine the effect of dehaulming (cutting of foliage) and curing on the physicochemical and morphological characteristics of roots for the pit storage technology and roots for export storage trial.

Sweetpotato, at 4½ months maturity, from Mpigi district was dehaulmed and left to cure for 0, 7, 14, 21, 28 and 35 days before harvest. The harvested sweetpotato was then divided into two portions; one portion was stored in a pit at prevailing ambient conditions for 90 days in the farmers' fields. The second portion was packaged in corrugated waxed cartons and stored in a cold room at 14°C for 60 days. Dry matter, sugar and starch content of the stored roots were determined before and after storage.

A decrease in the dry matter and starch content, and an increase in the sugar content with increasing curing duration were observed for roots in the pit store. In the case of roots kept at 14°C for export storage trial, sugar and starch contents were relatively constant and not influenced by curing duration. However, a small decrease in dry matter content was recorded suggesting the roots adsorbed moisture due to the high relative humidity of the cold room. The morphological characteristics a small percentage of the roots subjected to cold storage changed significantly with signs of decay, softening and mold development on the tips in roots. While the roots subjected to pit storage presented with rotting and severe sprouting, which could be attributed to rain water that reached the store roots and temperature. The results indicated that sweetpotato roots cured for 7 and 14 days had better morphological properties than those subjected to longer curing duration. It was found that dehaulming and curing had no significant effect on the physicochemical characteristics of roots and therefore could be adopted for export processing. It is recommended that further studies should be conducted to establish the optimal curing method and duration of sweetpotato roots for long-term storage.

4.2 Output 2: Post harvest capacity of rural sweetpotato farmers and processors in Central Uganda enhanced.

Title of activity: Cost benefit analysis of sweetpotato on farm enterprises

Farmers were expected to select post harvest technologies that enable them reduce post harvest losses and increase incomes from sweetpotato. A cost benefit analysis was conducted to determine the viability of sweetpotato post harvest technologies introduced to project beneficiaries viz.: production of juice, multiplication of vines, drying of sweetpotato to chips, production of sweetpotato flour and storage structures for fresh roots and dried sweetpotato chips. The study was undertaken in Luweero and Mpigi as the project target districts, and Mukono, a non-project district.

Both qualitative and quantitative data were collected using a pre-tested questionnaire. The data needed for the exercise included costs and benefits (direct and indirect) met by farmers in undertaking the various technologies, input requirements, prices of inputs and outputs, availability of inputs. Information regarding acceptability of the technologies by farmers was collected. The data collection techniques used were key informant interviews, focus group discussions and review of farm records and accounts. The study respondents were individual farmers and selected stakeholders of the sweetpotato coalition project.

Results of the cost benefit analysis show that sweetpotato production is a financially viable enterprise with regard to commercial production of tubers and vines, as well as post harvest technologies except for commercial juice production and chip making. As expected, the viable technologies generally require low startup capital and the products are highly demanded in all of the project districts. For every Uganda Shilling invested in the production of tubers and vines, farmers can obtain Shs. 2.4, 2.3, and 1.6 in Mukono, Luweero and Mpigi districts, respectively from the sale in local markets. These results imply that commercial production of sweetpotato tubers and vines is viable and so are worthwhile projects to the farmers. Investment in storage structures for sweetpotatoes is also worthwhile in all the districts of intervention in that for every Uganda Shilling invested in the construction and management of storage structures for sweetpotatoes, farmers can obtain Uganda Shillings 12.7, 15.9, and 12.7 in Mukono, Luweero and Mpigi districts respectively. These benefits largely accrue from savings on food and easing of food security constraints at the farmers' level. Investing in processing of sweetpotatoes to flour is also viable from the farmers' perspective in that for every Uganda Shilling invested, farmers can obtain Uganda Shillings 3.7, 2.0 and 1.1 for Mukono, Luweero and Mpigi districts respectively. Except for Luweero district, the investment in snack production out of sweetpotatoes is viable resulting in a gain of Uganda Shillings 1.1 for Mukono and Mpigi districts from every shilling invested. Commercial production of chips as well as juice is not worthwhile in all the intervention districts at 13% discount rate. With the unviable technologies, the present value of costs outweigh the present value of benefits largely due to large capital outlays required for production in a three-year period. Such investments may be worthwhile over a longer period of project life and a lower discount rate however.

Based on the findings, the following conclusions are made:

- i. Sweetpotato has the potential of improving household incomes of rural people and can hence be instrumental in fighting rural poverty. Commercial production of fresh roots both for the local and export market is viable and the financial indicators can improve when sale of fresh roots for either market is combined with sale of vines.
- ii. Production of chips is not viable in the short term; but may be viable in the long term and if a lower discount rate prevails.
- iii. Processing of flour is viable whether homegrown or purchased roots are used.

Recommendations regarding enhancement of sweetpotato-based technology viability are made and these focus on increasing farmers' organizations' negotiation skills and lead to better marketing of products, increased access to market information and undertaking more research and awareness geared towards improving market access for sweetpotato products.

Title of activity: Establishment of production requirements and characteristics of sweetpotato for the local and export markets

Specific sweetpotato production research activities to evaluate new varieties, effect of plant density and effect of time of harvest were prompted by commercial farmers who were exporting sweetpotatoes. The studies commenced with an exploratory visit to commercial farmers in Mpigi and Wakiso districts by a team of project partners from HORTEXA, NARO, CIP as well as BUCADEF. Two main locations in Nkozi and Bujuko sub counties in Mpigi and Wakiso districts respectively were visited because of their known commercial sweetpotato production activities. The visit aimed at establishing the existing knowledge, practices and constraints for commercial production of sweetpotato. The visit was also to identify relevant research gaps as well as interested farmer groups to undertake the research.

Discussions were held with 25 farmers at each site and hosting on farm trials was voluntary. Consensus was reached with farmers on type of on-farm trials to conduct. An explanation was given to the farmers on each type and size of trial and kind of data to collect.

The visit revealed that *NASPOT 1* (also called *Bwenge*, cream skin colour and yellow-fleshed), Tanzania (locally called *Soroti*, cream skin colour and yellow-fleshed) and *New Kawogo* (red skin colour and white-fleshed) were the most grown varieties for export and local markets. It was also found out that farmers experienced a lot of rejected roots as a result of rigorous grading of roots by exporters. Root size and shape are important attributes for easy packaging and marketing by the exporters. At the same time it was realised that farmers did not have any agronomic practices aimed at meeting the desired attributes by the market. Farmers were not sure of the right plant density and time of harvesting to get better sized and shaped roots. Trials were thus initiated with three commercial farmer groups to evaluate the effect of varieties, plant density, and time of harvesting on the root attributes for both export and local markets. Trials on varieties and plant density were done under farmer fields, while time of harvest was done by researchers in a selected field that was accessible to farmers. The tested varieties were; *NASPOT 1*, *493*, *93/29*, *Sowola 6*, *Kala*, *Ejumula*, *Kakamega*, *Kyabafuruki* and a local check (*New Kawogo*). *New Kawogo* and Tanzania varieties were used for the plant density experiment each planted at 3, 6, 8, and 10 vine cuttings per mound. For all the trials, each farmer field was considered as replication and at least three farmers planted a given trial.

Five varieties: *New Kawogo*, *Tanzania*, *NASPOT 1*, *Ejumula* and *Kakamega* were assessed for optimum time of harvesting. During the first season, harvesting was done at 5, 6 and 7 months after planting (MAP). If it were not for bad weather that destroyed the crop during the second season, harvesting was planned at 3, 4, 5, 6, 7 MAP.

The trials were repeated for a second season during 2004, though they were affected by bad weather. Basing on the 1st season preliminary findings, plant densities of 3, 4, 5, and 6 vine cuttings per mound were used to reach better conclusions.

Each plot consisted of 24 mounds, for all the trials.

At harvest, export marketable, local marketable and non marketable yield components were assessed, the diameter, length and shape of the roots for export were measured all with full involvement of farmers.

Preliminary observations based on first season data indicated that *NASPOT 1* and *New Kawogo* were still the most preferable varieties to farmers for both the local and export markets. This is because of the high root yields and desirable root shape. Farmers also showed preference for *Kakamega* and *493* for export and local markets. The orange-fleshed variety, *Ejumula*, was not ranked very high because of the poor root yields. *Ejumula* recorded high severity and incidence rates of virus disease at all study locations, which probably accounts for the low root yields.

Results from plant density study showed that the optimum plant population was 3 vines per mound as opposed to the farmers' practice of planting 4-9 vine cuttings per mound.

The optimum harvesting time was 5 months after planting, longer periods led to losses due to sweetpotato weevil attack, extra large roots unsuitable for the export market and rotting in early maturing varieties especially *NASPOT 1* and *Soroti* (also called *Tanzania*).

All these trials needed to be repeated to validate preliminary results and give recommendations of the optimum sweetpotato production practices to target export and local markets.

This was followed by training of farmers in rapid multiplication technique (RMT) and sweetpotato production management. A total of 120 farmers and farmer leaders from Mpigi, Luweero, and Kiboga districts were trained in February, July and September 2004 at NAARI and at Nkozi Sub- County.

Title of activity: Farmer selection of sweetpotato dried chips processing technologies

Previous research conducted at Kawanda Agricultural Research Institute developed a package of technologies for improving the efficiency and effectiveness of on-farm processing sweetpotato dried chips at farm level. The various technology options developed included processing equipment (motorised chipper, manual chipper, manual slicers, hand slicer) of different throughputs, drying structures (raised tray dryers, biomass dryers) and processing methods utilising unpeeled sweetpotato roots. To enhance adoption of these research outputs by the end users, researchers took the approach of taking into account user's opinion and preferences of technologies before disseminating them. Participatory demonstration trials of processing equipment was therefore conducted with the aim of giving opportunity to farmers/rural processors to select the technology options that they considered as most suited to their processing needs. The objectives of the research were to:

1. validate the suitability of the equipment for commercial dried chips processing at farm level
2. determine farmer's criteria for selection of processing equipment

Demonstrations of the dried chips processing equipment was done to the selected farmer groups. Farmers were then given an opportunity to get their hands on the equipment while taking note of features such as throughput, safety, drudgery, cost, quality (size) of sliced products etc. Participants selected the technology they preferred using a ranking procedure of 1 to 4, whereby 1 was most preferred and 4 least preferred. They also listed in order of importance the criteria that they used for selection of the equipment.

The farmer groups selected the motorised chipper (3.9) and manual chipper (3.8) as the equipment they preferred for use in commercial processing of dried chips. Selection criteria in order of importance was (1) throughput (2) reduction in drudgery (3) small size of chipped product (4) safety of equipment (5) cost of equipment. Farmers however indicated that though the motorised chipper compared to the other equipment had many advantages, its cost was too high and not affordable. The throughput of the lower cost hand slicer was considered as too low for commercial activities. The results of the selection criteria used by the farmers validated the fact that the motorised chipper is so far the most suitable equipment for commercial processing activities.

Title of activity: Selected physicochemical parameters of sweetpotato varieties grown in the target districts

A number of improved sweetpotato varieties have been introduced by CIP, NAARI and PRAPACE in the East African region. These varieties have been reported to possess improved agronomic characteristics (high yield and resistance to weevil) and high beta-carotene content. The objective of the study was to determine the content of selected physicochemical parameters of these improved varieties from the target districts of the project. Dry matter, starch and beta-carotene contents, and sugar profile of sweetpotato were determined. Luweero district typically grows the yellow and orange-fleshed varieties, while Kiboga and Mpigi grow mainly the white-fleshed varieties. *NASPOT 1* and *Soroti*, which are yellow-fleshed varieties, were the only varieties with relatively high beta-carotene varieties grown in Kiboga and Mpigi. All sweetpotato varieties from the 3 districts contained dry matter levels of more than 30%, with varieties from Mpigi (*NASPOT 2*, *New Kawogo* and *Semanda*) having the highest dry matter contents of up to 40%. Sugar profile of sweetpotato showed that they

contained sucrose, fructose and glucose, which is typical of sweetpotato. Maltose was found as trace levels in one variety. Total sugar levels of sweetpotato varieties were 1.5 g/100 g for the white-fleshed varieties, *New Kawogo* and *Semanda*, and 0.5 g/100g for the yellow-fleshed, *NASPOT 1* and *Soroti*. Variations in starch contents were obtained from sweetpotato in the three districts. A few varieties contained as low as 40% starch (dry basis), while the majority contained 50-70%. *New Kawogo* and *Semanda* varieties from Mpigi district had exceptionally high starch contents of up to 90% on a dry weight basis.

Variations in beta-carotene content were also recorded. The yellow and orange-fleshed varieties from Luweero district had the highest beta-carotene levels, on a dry weight basis, *Ejumula* (approx. 100,000 µg/100 g) containing the highest, followed by *SPK004* (approx. 60 mg/100 g), *Soroti* and *NASPOT 1* (approx. 2 mg/100 g). Low or trace beta-carotene contents (<100 mg/100 g) were measured for the white-fleshed varieties (*New Kawogo* and *Semanda* varieties) that were obtained from Mpigi district.

Title of activity: Validation of storage technologies for sweetpotato roots

Harvesting sweetpotato in a piece meal manner is the practice of sweetpotato small-scale farmers in Uganda, also typical of Central Uganda. However, the longer the sweetpotato stays in the field after maturity, the higher the losses will be due to weevil infestation. On the other hand long-term storage technologies have been tested elsewhere in East Africa and proved to enhance the shelf-life of sweetpotato. The objectives of this study were:

1. introduce long-term storage technologies to the project farmers
2. determine the effects of duration of storage on the morphology, physiology and acceptability of stored sweetpotato
3. determine the effect of duration of storage on the selected physicochemical parameters (dry matter, beta-carotene and sugar) of the stored sweetpotato

The study was conducted in participatory manner in selected farmer sites of Luweero and Mpigi districts. Clamp and pit stores (Fig 5 and 6) were constructed by farmers in both districts. Farmers' sweetpotato in the respective districts was stored in the clamp and pit stores and stored for 90 days in Luweero and 60 days in Mpigi. Sweetpotato varieties *NASPOT1*, *Dimbuka*, *Ejumula*, *Ssemanda*, *NASPOT 2*, *New Kawogo* and *SPK004 (Kakamega)* harvested at 4½ to 5 months maturity were used for the study. The stored roots were analysed, on a monthly basis, for dry matter, sugar and beta-carotene contents. Sensory evaluation of the stored roots was done by the farmers who assessed the appearance, flavour and texture (degree of mealiness) of cooked (steamed) roots. Farmers also assessed physiological condition, extent of sprouting, weevil infestation, rotting and shrivelling of the stored sweetpotato, using a scoring scale where 1 indicated very poor quality and 5 indicated very good quality.

Farmers preferred the pit storage to the clamp, because pit stores are easier to construct and maintain unlike the clamp stores. Farmers established that sweetpotato roots can be stored using the pit and / or clamp under local conditions. The roots were found acceptable for household consumption, but not for commercial purposes after storage. Of the varieties that were stored, *Ejumula* and *Naspot1* had the most acceptable morphological characteristics. Farmers preferred *Ejumula* variety for its good appearance, and relatively good taste and texture after storage. Variety *Naspot1* was considered relatively good in appearance, flavour and mealiness up to 2½ months storage. In addition, *Ejumula* and *Naspot1* were not significantly affected by weevil infestation or rotting during storage unlike *Dimbuka* and *SPK004*. *Ejumula* did not shrivel significantly. The findings showed that sprouting, weevil infestation, rotting and shrivelling reduce the quality of stored roots and in turn lower acceptability of the crop. It was found that stored roots of the above varieties were reasonably suitable for home consumption up to 2½ months, but would not be suitable for marketing.

Dry matter contents of sweetpotato were exceptionally high, particularly for those from Mpigi district, with the *Semanda* variety having the highest dry matter of 41%. High beta-carotene concentrations of 68 and 125 mg/100 g were recorded for the orange-fleshed varieties, SPK004 and *Ejumula*, respectively. Total sugar contents of the roots were generally low ranging from 1.6 to 3.7 g/100 g, with exception of *NASPOT 2* that had 5.7 g/100 g. Changes in dry matter, beta-carotene and sugar contents of sweetpotato depended on location. No consistent trends of changes in the content of dry matter, reducing sugar and sucrose were noted for sweetpotato from Luweero district regardless of the type of store. A decrease in sugar content noted for Mpigi sweetpotato was due to a general decrease in sweetpotato dry matter.

Beta-carotene dramatically reduced with duration of root storage in clamp and pits, for all varieties, particularly the orange-fleshed varieties, *Ejumula* and *SPK004* (Fig 7 and 8). This could possibly have been due to the prevailing ambient conditions that hastened enzymatic degradation of beta-carotene. However, the residual beta-carotene content (2.6-3.4 mg/100 g, dwb, which is equivalent to 433-567 R.E/100 g of vitamin A) of *Ejumula* and *SPK004* if compared to white-fleshed varieties that have trace levels, would still be adequate to contribute to the recommended daily allowance (RDA) of vitamin A intake for children. The RDA for the under-five year olds and 7–10 year children are 400-500 R.E/ 100 g, and 700 R.E/ 100 g, respectively. Further analysis of beta-carotene content is still needed to ascertain the high beta-carotene contents of the improved varieties, which is however dependant on geographical location, handling and sampling procedures of roots beta-carotene analysis.



Figure 5 Storage of sweetpotato in a clamp store (a) Farmers covering sweetpotato roots with dry grass (b) covering with a grass-thatched roof

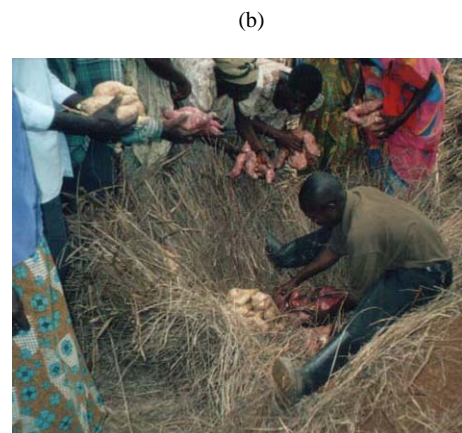


Figure 6 Storage of sweetpotato in a pit store (a) Lining the pit with dry grass (b) Farmers place sweetpotato roots in a pit

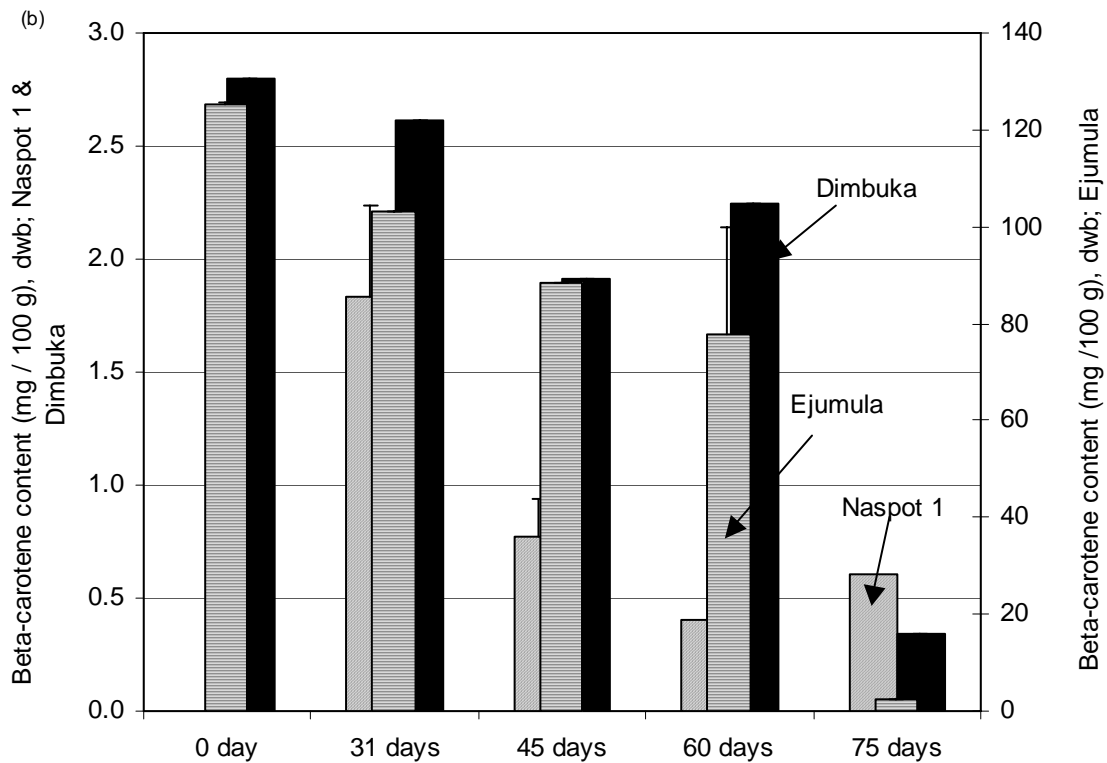
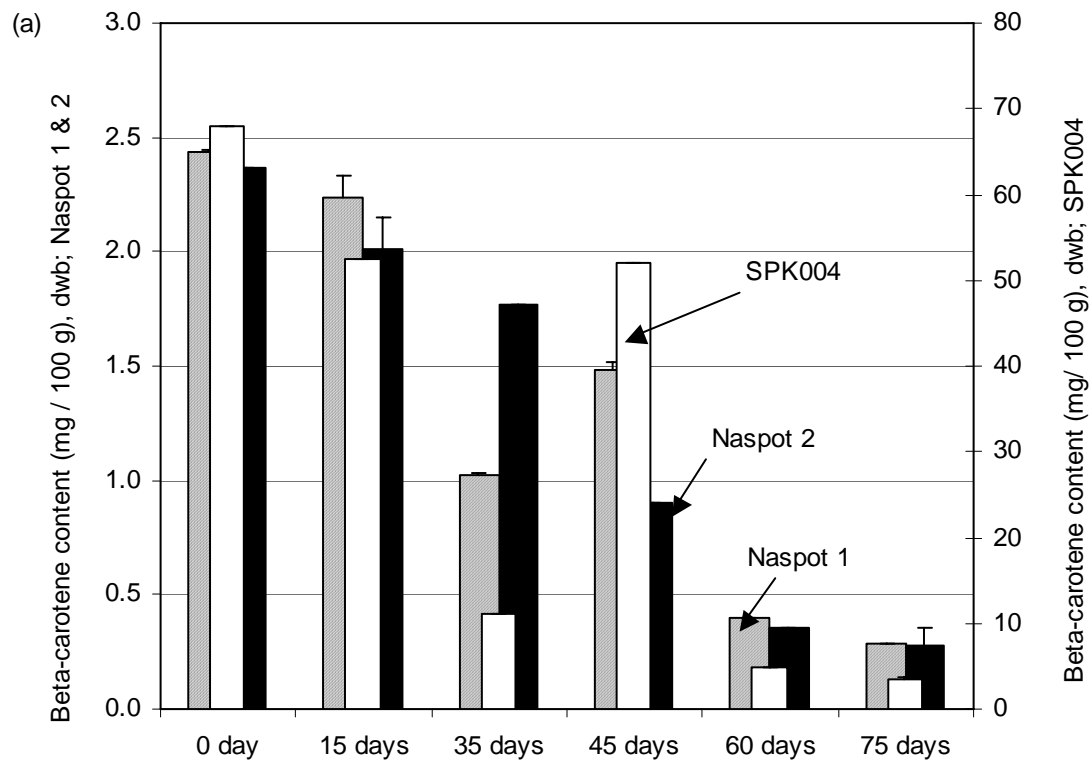


Figure 7. Change in beta-carotene content of sweetpotato roots with duration of storage for Luweero district (a) pit store in Kalagala sub county (b) clamp store in Zirowbwe sub county

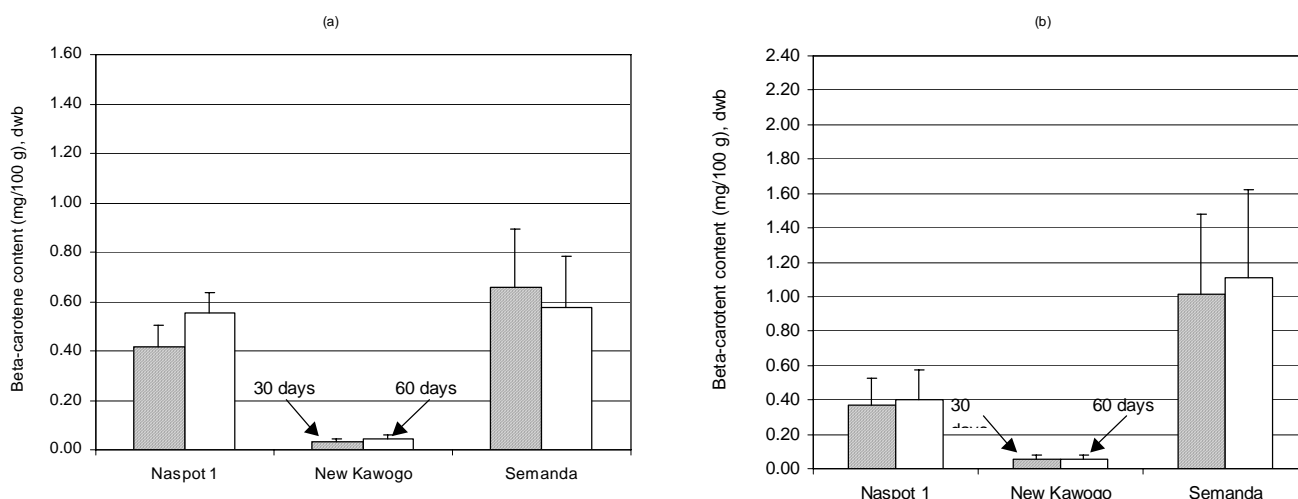


Figure 8 Change in beta-carotene contents of sweetpotato roots at 30 and 60 days of storage in Nindye, Mpigi district (a) clamp store (b) pit store

Title of activity: A training of trainers workshop held

Transferring sweetpotato knowledge and skills to farmers (end-users) was a crucial activity for the project to achieve its purpose. Farmers had knowledge of selection of clean planting material and identification of sweetpotato diseases. The post harvest knowledge was then timely to add to the production knowledge to improve the sweetpotato sub-sector.

A Training of Trainers' workshop was held in September 2003 to produce skilled and knowledgeable trainers in post harvest handling and marketing technologies and to develop an action plan for training farmer groups. Twenty three participants from the project area of Luweero, Kiboga, and Mpigi districts as well as from the neighbouring districts of Kampala, Wakiso and Mukono were successfully trained.

The training approach was highly participatory and the methods included plenary presentations followed by specific discussions, group work, brainstorming, group discussions. Field visits and practicals were done to enable participants to have hands-on experience especially in storage and processing

The sessions/topics that were covered in the training included:

- Importance of sweetpotato for economic development & pre-harvest factors affecting post-harvest quality of sweetpotato.
- Quality aspects of sweetpotato roots for both local and export markets
- Nutritional value of sweetpotato
- Post harvest handling of sweetpotato roots and its products
- Sweetpotato marketing in Central Uganda
- Sweetpotato storage technologies for both fresh and dried chips.
- Handling of fresh produce for export
- Processing aspects of sweetpotato

Field visits were made to Fresh Handling Ltd, at Entebbe and Kawanda Agricultural Research Institute (KARI). At KARI, participants had hands-on practicals in constructing storage structures and making sweetpotato chips/snacks such as chapatti, crisps, and cakes. At the Fresh Handling Ltd company, participants were introduced to the pack house activities before export, which included cooling, sorting, grading and packaging. Emphasis

was on the importance of proper handling after harvest, as it impacts on the quality of the produce. The company is mainly involved in handling fresh produce such as fruits, vegetables and flowers for export.

At the end of the workshop, participants discussed the way forward and made action plans to carry out the following activities:

- Identification and mobilization of farmer groups for project activities
- Mobilization and sensitization of communities and schools
- Dissemination of the knowledge and skills acquired from the workshop to other farmers
- Setting up of demonstration sites for storage and processing

At the end of each session/topic participants were given training protocols for future reference.

Title of activity: A follow-up workshop for the trainers held

A follow up workshop, for trainers trained during the first workshop was held on 5-6th August 2004.

Objectives of the workshop were to:

1. share experiences and challenges in the dissemination of post harvest knowledge, technologies and marketing of sweetpotato products.
2. share experiences on the institutional framework of the coalition.
3. provide backstopping to trainers by the coalition

The workshop involved group discussions, presentations in plenary and a field visit to a pack house for handling fresh produce for export.

Major achievements reported by the trainers included:

- Training of 17,030 project beneficiaries. Emphasis was on pre and post harvest technologies, which included varieties, agronomic practices, nutrition, processing of snacks, juice, flour, and income generation.
- Establishment of 740 acres of improved sweetpotato for market
- One trainer reported selling 500 bags of vines (800 vines per bag) to fellow farmers and earned 9,000,000 shillings (equivalent of US \$ 5143).

Problems and challenges experienced:

- Trained farmers demanded free vines
- Shortage of orange-fleshed varieties resistant to virus diseases
- Drought
- Delayed and sometimes non-payment to farmers by buyers
- Shortage of land in schools for sweetpotato production
- Unavailability of transportation facility

The following recommendations were made to strengthen linkages among partners and ensure sustainability for increased impact by the project:

- Strengthen and start programmes, for example, radio programmes to sensitize community about value added products of sweetpotato, and hence encourage farmers to produce more to meet market demands
- Continue backstopping trainers
- Encourage farmers groups to form association for bigger voice
- Involve district councillors in the project for sustainability
- Facilitate trainers in terms of transport and allowances

4.3 Output 3 Sweetpotato based income-generating opportunities created for the resource poor youth and women.

Title of activity: Farmer selection of sweetpotato based micro-enterprises for income generation

Previous research conducted at Kawanda Research Institute developed recipes for various sweetpotato based products including deep fried products, bakery products and juices. The research outputs aimed at creating opportunities for rural communities to establish sweetpotato based micro-enterprises for income generation. To enhance adoption of the research outputs, sensitization and demonstration trials were conducted with selected farmer groups with the following objectives:

1. Create awareness among the farmers about sweetpotato based secondary products. Identify farmer groups for use in selection of preferred micro-enterprises
2. Identify the products preferred for establishing micro-enterprises
3. Identify farmer criteria for selection of the products

A total of ten farmer groups were sensitised about sweetpotato products. Information provided to the farmers included: the forms of semi-processed sweetpotato (fresh grated sweetpotato, boiled-mashed sweetpotato & sweetpotato flour) used as an ingredient in the products, their nutritional and economic advantages and potential markets. Samples of the products including sweetpotato dried chips, mandazi, chapati, crisps, bagia, kabalagala, cakes, buns, cookies, juice and flour that were processed on-station at Kawanda were presented to the participants for viewing and tasting. Participants then selected the products using a scoring method.

Product preference varied among the farmer groups. Generally, however dried chips, mandazi, chapati, juice and flour were rated highest. Respondents indicated that they used the following criteria to select the products: (1) availability of markets (2) costs involved in processing and benefits derived from products (3) availability of processing technology such as equipment, ovens etc.

Results of this study validated the importance of markets in enterprise establishment. It was therefore concluded that it is important to analyse the market first and determine the costs and benefits before investing in technology for enterprise establishment.

Output 4 Institutional mechanism that empowers poor farmers/rural processors to participate in sweetpotato technology and knowledge innovation systems (TKIS) developed

Title of activity: Farmers mobilised for project activities

The coalition's initial research activities required sensitisation and mobilisation of farmers who were supposed to participate in subsequent research activities of the project. To-date a total of 37 farmers groups consisting of 40 farmers per group have been mobilised. These constitute the core farmer partners of the coalition and the newly proposed Sweetpotato Development Association.

Title of activity: Sweetpotato coalition final review workshop

A two day workshop which brought together implementers and other stakeholders to reflect and evaluate the extent to which project outputs had been achieved, the lessons learnt and propose ways of sustaining the coalition, was conducted on 16- 17 December 2004. A total of 38 participants drawn from the 12 Coalition partners and other stakeholders attended the workshop. They included representatives from research (NAARI, KARI, FOSRI); Makerere University (MAK-FST); Extension/farmer support organizations (HORTEXA); schools (EDL/BRIBTE); Collaborating NGO (VEDCO); farmers from Luweero, Mpigi, and Kiboga districts, the Managing Partner (PRAPACE) as well as the sweetpotato project M&E facilitators. The workshop utilized a variety of techniques aimed at promoting individual reflection as well as group discussion/sharing and analysis of experiences. The main techniques used included presentations by representatives from each of the Coalition Partners, plenary as well as group discussions. In addition, participants individually completed a table, which sought for information on their individual opinions about the extent to which project objectives and selected activities had been achieved.

The tangible outputs of the workshop were results of the group assignments and brainstorming sessions that evaluated the extent of achievement of project objectives, a reflection on the lessons learnt as well as proposals for the way forward. The following highlights the key workshop outputs:

Extent to which objectives/activities were achieved: It is worth noting that project achievement and potential impact needs to be looked at in a context of a short project implementation time frame. Implementation of project activities has been for about two years and therefore impact is expected in the future. Overall, participants were of the view that achievement of project goal and purpose was above average. The dissemination of appropriate post harvest technologies and user-friendly materials to farmers were ranked as the best achieved outputs with score ranking of over 70%. The general assessment of project objectives indicated that the level of achievement was above average with the exception of linking farmers to export markets (32%) and to credit and/or financial institutions (23%). In view of the above, participants were of the opinion that the project had registered positive impacts. Among others, these included; increased awareness on the importance of sweetpotato as an income generating crop, increased knowledge and skills in post harvest handling, processing and storage of sweetpotato, improved attitude towards sweetpotato, increased incomes through the sell of sweetpotato and its products, improved food security, as well as establishment of and strengthened linkages between farmers and various service providers that has led to a process of farmer empowerment. Commitment and cooperation between coalition partners and availability of project resources were cited as some of the factors that have contributed towards project success. Given all this the coalition believes that the project goal was generally achieved and what couldn't be done was due to factors such as lack of funds that couldn't be influenced by the project. On the other hand, limited financial resources, delayed start of initial baseline activities, prolonged drought in some areas making it difficult for farmers to grow sweetpotato as well as limited access to sweetpotato markets, merged out as some of the key factors that had constrained project implementation.

Lessons learnt: The key lessons learnt focused on the importance of working together and therefore the need to strengthen the collaborative activities between the various partners. It came out strongly that farmers could most effectively deal with challenges associated with sweetpotato production, processing and marketing if they worked together in organized groups or associations. However, some participants pointed out the need for increased commitment on the part of coalition partners.

Way forward: It was unanimously agreed that the coalition should continue to exist and that all efforts be made to ensure that its activities further get strengthened. In view of this, the

following were suggested as strategies to work towards this end: That all partners proactively get involved in soliciting funds through project proposal development; that a process of forming a Sweetpotato Development Association be initiated and a steering committee to guide the process be formed.

As part of the way forward it was agreed that members complete pending activities and most efforts be geared towards accomplishment of the sea freight shipment of fresh sweetpotato which was likely to provide a break through in market access for fresh sweetpotato.

5 Project effectiveness

Table 2 Rating project effectiveness

	Rating
Project Goal	2
Project Purpose	2
Project Outputs	
1 Rural SP farmers in central Uganda linked local and export markets	2
2. Post harvest capacity of rural sweetpotato farmers and processors in Central Uganda enhanced	2
3. Sweetpotato based income-generating opportunities created for resource poor youth and women	2
4. Institutional mechanism that empowers poor farmers/rural processors to participate in sweetpotato technology & knowledge innovation systems (TKIS) developed	1

- 1= completely achieved
- 2= largely achieved
- 3= partially achieved
- 4= achieved only to a very limited extent

Table 3 Research outputs achieved by the project

Objectively Verifiable Indicators	Research output achieved	Reasons for not achieving outputs
1.1 Sweetpotato production capacity and processing potential quantified by end of 1 st quarter of year 2.	<ul style="list-style-type: none"> Average production per household was about 0.75 acres and average yield was 6.9 t/acre. 	<ul style="list-style-type: none"> Processing potential wasn't quantified because farmers lacked varieties required for processing
1.2 At least 30 local markets capable of absorbing at least 50% of fresh sweetpotato identified and their demand characteristics established with respect to production by the end 1 st quarter year 2.	<ul style="list-style-type: none"> A total of 20 local markets identified (including three traders, two companies -Kawerimide Bugerere Stores & Butezza Stores, nine Schools, three Universities, two Hospitals, one NGO) for fresh sweetpotato roots and planting materials and linked with the 37 farmer groups. Demand characteristics not fully established. 	<ul style="list-style-type: none"> The markets did not fully specify the characteristics
1.3 At least 5 existing or potential markets identified for processed sweetpotato products and their demand characteristics established by end of 3 rd quarter of year 2.	<ul style="list-style-type: none"> Six markets (Five food processing industries and one feed industry) were identified. One milling industry is currently absorbing two tonnes per month of which 90% are being supplied from outside the project area. 	
1.4 At least 5 sweetpotato export markets in the European Union (E.U) identified and characterised by the end of 2 nd quarter of year 2	<ul style="list-style-type: none"> Addresses of 300 potential importers from Europe were identified and one company JIMMY PAN IMPEX LTD-London accepted to participate in the first trial shipment. A representative of the company who came to Uganda in November 2004 expressed the interest of the company to import large quantities of sweetpotato in future starting from 80 tonnes per month at initial stages provided the produce could reach Europe at a price competitive enough to match produce from major competitors like Egypt, Israel and South Africa. The most preferred varieties were those with red skin and medium sized roots. 	<ul style="list-style-type: none"> The actual shipping of fresh sweetpotato roots did not take place due to lack of funds
1.5 Contractual linkages	<ul style="list-style-type: none"> Farmer groups were linked to identified markets groups but 	<ul style="list-style-type: none"> Business groups were not willing to go into

established between farmer groups and identified markets including terms of transaction of sweetpotato by end of year 2	no contracts signed.	contracts <ul style="list-style-type: none"> Some markets (e.g. Hospitals) demanded that farmers needed to have bank accounts to be able to transact business
2.1 Post harvest technologies (PHTs) provided to at least 20 farmer groups and suitable PHTs that facilitate sweetpotato farmers and rural processors to access new market opportunities selected by the end of year 2.	<ul style="list-style-type: none"> 37 Farmer groups were reached. Post harvest technologies provided included: <ul style="list-style-type: none"> Improved varieties Processed products Curing and packaging Storage structures for fresh roots dried sweetpotato chips Drying structures and chipping equipment 	
2.2 By end of project life, at least 90% of farmer and rural processor groups exposed to PHT packages and able to demonstrate knowledge and skills in post harvest handling and processing of sweetpotato.	<ul style="list-style-type: none"> Twenty-three trainers (farmer leaders, agricultural extension workers and teachers) were equipped with knowledge and skills of sweetpotato post harvest technologies (PHTs) in the areas of storage, processing and marketing. The trained trainers sensitised 37 farmer groups and 17 schools. To date over 17,030 project beneficiaries have been trained. 	
2.3 At least 6 sites are being used for demonstration of selected PHTs in three target districts by the end of year 3.	<ul style="list-style-type: none"> 14 sites with demonstrations of sweetpotato storage technologies (pit, brick and mud stores), processing technologies (drying trays, chippers, juice processing, baking ovens and snack products) were established 15 trial centres for variety evaluation, plant density, and time of harvesting were also established 	
3.1 At least 5 profitable sweetpotato fresh root and processing enterprises identified and developed with 5 farmer groups and 5 processor groups by the end	<ul style="list-style-type: none"> Six profitable sweetpotato based enterprises (fresh roots, dried chips, flour, snacks, vines, juice) were identified and developed with 4 farmer groups 	

of the 3 rd quarter of year 2.		
3.2 At least 50 % of the farmer and processor groups trained in enterprise establishment and management, acquire and use post harvest technologies to access markets with value-added products by the end of the project.	<ul style="list-style-type: none"> • 75 representative farmers from 27 farmer groups (9 groups per target district) were trained in business skills and enterprise management. • Four farmer /rural processor groups process sweetpotato juice and snacks, which they sell to schools, hospitals and the community around. The groups also process dried chips and sell to the milling industry 	<ul style="list-style-type: none"> • Due to limited funds and for effective training, it was not possible to reach all farmers. • However, it is expected that the trained farmer representative will train other farmers in their groups.
4.1 At least 50 farmer groups composed of mainly small-scale sweetpotato producers and processors registered through the coalition partnership by end of 2004	<ul style="list-style-type: none"> • 37 farmers' groups (15 of which are also rural processor groups) were mobilized, sensitised and registered about project activities. • Eight business groups were formed by farmers, of which four legally registered in Zirobwe, Luweero district. 	<ul style="list-style-type: none"> • Mobilisation of farmer groups is a slow process and it cannot be rushed
4.2 A self-sustaining coalition of relevant stakeholders put in place by the end of 2004.	<ul style="list-style-type: none"> • Three (3) major workshops were held to plan, review and strengthen the partnership. • The coalition formed a sweetpotato development association and is in the process of registration • Student agricultural clubs were formed in 11 schools for sustainability of the project 	
4.3 At least 50 farmer and processor groups aware of the available credit and development grant sources (such as project donor funding, NAADS, micro finance), and loan and grant acquisition requirements by November 2004.	<ul style="list-style-type: none"> • 37 farmer and processor groups were made aware of available credit institutions and their requirements • 	
4.4 Mechanisms for dissemination of	<ul style="list-style-type: none"> • User friendly dissemination packages both in English and local language –Luganda (1000 sweetpotato training 	<ul style="list-style-type: none"> • The demand for the user friendly packages was beyond the project expectations. It was

<p>sweetpotato post harvest knowledge & technologies to rural communities developed by the end of year 3 (or project life)</p>	<p>manuals, 1000 calendars of 2004, 2000 posters and 1000 promotional leaflets) for adoption of post harvest technologies were developed and distributed to farmers, processors and other stakeholders.</p> <ul style="list-style-type: none"> • 23 trainers were trained in a training of trainers' scheme and were being used as service providers to train communities and schools. • Rural processing centres and on-farm trials (Rapid multiplication centres, storage structures) were established at 14 sites for further dissemination of the technologies • Post harvest technologies were introduced to 17 schools. School children and teachers subsequently would channel the knowledge to the grass roots. • A website (www.sweetpotatocoalition.org) was developed for sharing and dissemination of information on sweetpotato production (varieties, acreage planted) and processing potential • Other mechanisms were participation in agricultural shows (national and international), and Weekly farmer programmes on local FM radios (CBS in particular). 	<p>not possible to meet the demands due to limited funds</p>
--	---	--

Purpose

Extent to which purpose was achieved.

The project aimed to contribute to reduction of post harvest losses through the evaluation and dissemination of suitable technologies for production, storage and processing of sweetpotato into higher value products as well as increasing incomes of farmers by linking them to promising markets of sweetpotato and its products.

Project partners used approaches that involved the participation of end-users to validate and evaluate the feasibility of technologies. The end users also identified technology options most suited to their needs. Research results were validated as potentially effective at different levels as follows: At the farmer level, results of the agronomic trials demonstrated to farmers the potential feasibility of using a lower plant population (3 vines per mound as opposed to their practice of 4-9 vines per mound) to produce roots that meet export market quality requirements. Results of the sea freight simulation study indicated that export of sweetpotato by sea is technically and economically feasible. By conducting storage trials on the farm, the project demonstrated to farmers the effectiveness of pit and clamp stores in storing fresh roots for a period of two and a half months. Farmers in turn identified the pit method of storage as more suitable to their storage needs because it was cheaper to construct than the clamp store.

Results of the participatory demonstration trials of technology options for on-farm processing of sweetpotato validated the suitability of the motorised and manual chippers for commercial processing of sweetpotato into dried chips. The farmer/rural processor groups also selected sweetpotato dried chips, mandazi, chapati, juice and buns as the most preferred products for micro-enterprise establishment. The end users ranked market availability as the most important criteria used to select the sweetpotato products. These results validated the importance of markets in establishing successful enterprises.

To enhance adoption of these technologies, the project used pilot processing centers to conduct hands-on skill training of end-users. Ten farmer/rural processor groups were trained in these centers. Further more, the project organised a training of trainers workshop and trained twenty three trainers (farmer leaders, extension agents and teachers). These trainers were financially supported by the project to train other potential end users of the post harvest technologies. The project as well developed user friendly packages (posters, manual, handouts) and a web site for dissemination of project outputs.

Promising markets were also identified and linkages established in the product supply chain to promote the marketing of sweetpotato and new processed products. Farmers sold fresh sweetpotato roots to local markets in and around Kampala including hospitals, schools, higher institutions of learning and village markets. The farmers who processed dried chips from sweetpotato sold the products to milling industries. Farmers sold vines to non-government organisations and other buyers. Sweetpotato snack products and juices were sold to schools and local markets. This contributed to higher incomes of households

At the processor level, awareness about sweetpotato processing technologies was created in flour milling industries. Results of the surveyed flour millers identified privately owned flour milling/processing industries as potential markets for processed sweetpotato dried chips. Processing trials conducted with the millers also demonstrated the technical feasibility of sweetpotato composite flour processing. Results of the shelf life study and nutritional analysis of the processed flour validated the effectiveness of

yellow fleshed sweetpotato varieties in producing sweetpotato products with adequate shelf life. These research activities led to a number of end users and intermediaries to adopt the research outputs. Based on these results, it was concluded that the project purpose was greatly achieved.

Goal

Contribution of outputs to Project Goal

The project goal was that national and international crop post harvest systems respond more effectively to the needs of the poor. Project outputs aimed to contribute to the goal by stimulating post harvest innovations that benefit the poor. Post harvest innovations were made available by the project through the involvement of multiple partners drawn from the public and private sector institutions. The project partners provided support in the organization of the small scale farmers into groups. The groups were then supported by project partners to identify, acquire and use suitable post harvest technologies to reduce post harvest losses and add value to sweetpotato. Through the support provided in training, the farmer/rural processor groups acquired knowledge, operational and business skills that enhanced their capacity to respond more competitively to identified market opportunities. The project also established links in the sweetpotato product supply chain for promotion of the marketing and consumption of sweetpotato and the derived processed products. Project partners further supported the farmers and processors to establish sweetpotato based enterprises for generating income. Generally, the outputs contributed greatly to the goal of the project.

6 Uptake and Impact

Organisational Uptake

Uptake of research outputs by other intermediary institutions or projects (local, national, regional or international)

The intermediary institutions /programme were local, national and international. These included: VEDCO, Send a Cow, Uganda change agent, Members of Parliament, Resident district commissioners, Mayors, District local councils, NAADS and World vision international – Masaka branch. These institutions used the trained trainers as service providers to train farmer groups and communities within and outside project areas on processing sweetpotato snack products, making juice and growing improved varieties for market. The institutions purchased sweetpotato vines from farmer groups in the target districts and distributed farmers in non-project areas.

End user uptake

Uptake of research outputs by end-users

Three rural-based pilot processing centers were established in Luweero and Kiboga districts. Farmers were producing sweetpotato-based snack products, dried chips, juice and flour at household level for commercial purposes. One urban medium-scale food-processor, Kasawo Grain Millers in Kampala district was using OFSP as an ingredient in processing sweetpotato composite flour. On-farm storage technologies (pits, clamps and brick stores) were adopted by individual farmers among the 37 groups. The farmer groups indicated they would construct them as the storage need arises.

Knowledge

Impact of the project on the stock of knowledge

The project through training and sensitizations provided new post harvest knowledge to targeted end users. The new knowledge included; improved agronomic practices for achieving export market quality attributes, improved varieties for markets, sweetpotato storage methods (clamp, pit, silo), sweetpotato processing technologies (chippers, dryers), recipes for various sweetpotato products, production of fried and baked snack products like cakes, chappati, mandazi, and extraction of juice. Other areas of new knowledge were entrepreneurial development, participatory monitoring and evaluation methods. The impact is that the end users have used knowledge gained to reduce losses, add value and even accessed more markets.

Institutional

Impact on institutional capacity

Farmers in the target area are more organised, have been empowered to respond to market opportunities, some have evolved into business groups. They have better access to institutions providing post harvest technologies. The trained trainers who were equipped with sweetpotato post harvest technologies are being used as service providers by various institutions to train other communities. The flour milling industry has increased the range of flour products being sold. The intermediary organisations e.g. NGOs have increased the range of post harvest technologies to give to end users. Partner institutions gained by sharing and exchanging new knowledge on post harvest technologies.

Policy

Impact on policy, law or regulations

The project and its activities were in line with government's policies of Poverty eradication action plan (PEAP) and Plan for Modernisation of Agriculture (PMA), which are Uganda's governments' efforts to reduce poverty. The project organised rural sweetpotato farmers and linked them to development institutions that provide post harvest technologies, and advice to farmers. The project provided market information and linked farmers to markets. It gave farmers, particularly the poor, women and youth, powers to solicit for advisory services for their priority enterprises. Hence farmers have been able to earn income and improve their livelihoods.

Poverty and livelihoods

Impact on poverty or poor people and livelihoods.

Because farmers are organised, they have better access to markets and institutions providing support in post harvest innovations. Sweetpotato based enterprises for income generation were introduced. Income increased as a result of sweetpotato products sales (vines, fresh roots, value added products). Knowledge on post harvest technologies improved, food security improved, some households were able to cater for household basic needs like medical expenses, paying school fees. Other benefits included employment created, improved nutrition through consumption of orange-fleshed sweetpotato, social status (farmer groups were visited by parliamentarians, other farmer groups, people from as far as Kenya, South Africa, Denmark).

Environment

Impact on the environment

Project activities conducted had no negative impacts on the environment. Practices promoted involved zero use of inorganic chemicals that would pollute the environment. Plant nutrients were recycled as sweetpotato peelings were fed to

animals e.g. pigs; the vines after harvest were fed to cows which improved milk yields. Manure from the animals was returned to the fields for soil fertility. Waste generated from processing sweetpotato was also fed to animals.

	Signature	Date
Task force		
Mr. James Nsumba
Mr. Silver Tumwegamire
Dr. Agnes Namutebi
Ms. Hedwig Natabirwa
Ms. Constance Owor
Ms. Immaculate Sekitto
 Managing Partner		
Dr. Berga Lemaga

7 Annexes

7.1 Annex I: Concept note

See attached document

7.2 Annex II: Project Logical Framework

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Risk
Goal			
National and international crop-post harvest innovation systems respond more effectively to the needs of the poor.	<p>By 2005, a replicable range of different institutional arrangements which effectively and sustainably improve access to post harvest knowledge and/or stimulate post harvest innovation to benefit the poor have been validated in four regions.</p> <p>Please refer to the relevant Regional log frame to amend this indicator</p>	<p>Project evaluation reports.</p> <p>Partners' reports.</p> <p>Regional Co-ordinator's Annual Reports.</p> <p>CPHP Annual Reports.</p> <p>CPHP Review 2005.</p>	<p>National and international crop-post harvest systems have the capacity to respond to and integrate an increased range of research outputs during and after programme completion.</p> <p>National and international delivery systems deliver a range of services relevant to poor people in both focus and non-focus countries.</p> <p>Livelihood analysis provides accurate identification of researchable constraints or opportunities that lead to poverty reduction.</p>

Purpose	Objectively verifiable indicators	Means of verification	Risks and Assumptions
Sustainably reduced post harvest losses of	Post harvest losses of sweet potato grown by at least 2,000 farmers (120 farmer groups) with less than 3 acres in Central Uganda reduced by at least 50% of the current	<p>Project reports</p> <p>Loss assessment Protocols</p>	<p>Stable political and economic environment</p> <p>Farmers continue growing sweet potato for the</p>

sweet potato and increased incomes from sweet potato and its products in central Uganda.	levels by the end of the project.		market and remain interested in the project
Outputs			
1.0 Rural Sweet potato (SP) farmers in central Uganda linked to local and export markets	<p>1.1 Sweet potato production capacity and processing potential quantified by end of 1st quarter of year 2.</p> <p>1.2 At least 30 local markets (schools, supermarkets, hospitals) capable of absorbing at least 50% of fresh sweet potato identified and their demand characteristics established by the end 1st quarter year 2.</p> <p>1.3 Existing and at least 5 new market opportunities identified for processed sweet potato products and their requirements in terms of quality, quantity and regularity in supply processed raw material established by end of 3rd quarter of year 2.</p> <p>1.4 At least 5 sweet potato export markets in the European Union (E.U) identified and characterised by the end of 2nd quarter of year 2</p> <p>1.5 Contractual linkages established between farmer groups and identified food processors,</p>	<p>Project reports</p> <p>District service reports</p> <p>Service providers' records</p> <p>Field reports</p> <p>Farmer group records</p>	<p><i>Stable political environment</i></p> <p><i>Good infrastructure exists</i></p> <p>Favourable prices for sweet potato & its products</p> <p>Suitable climatic conditions especially rainfall</p>

<p>2.0 Post harvest capacity of rural sweet potato farmers and processors in Central Uganda enhanced</p>	<p>institutions and export markets including terms of transaction (supply, payment and transport) of sweet potato by end of year 2</p>		
	<p>2.1 Post harvest knowledge provided to at least 20 farmer groups and suitable post harvest technologies that facilitate sweet potato farmers and rural processors to access new market opportunities selected by the end of year 2.</p> <p>2.2 By end of project life, at least 90 % of the farmer and rural processor groups exposed to PHT packages able to demonstrate knowledge and skills in post harvest handling and processing of sweet potato.</p> <p>2.3 At least 6 sites are being used for demonstration of selected post harvest technologies in three target districts by the end of year 3.</p>	<p>Document of PHT packages</p> <p>Training synopses</p> <p>Farmer group records</p> <p>Project reports</p> <p>Service providers' records</p>	<p>Suitable climate prevails.</p> <p>Full commitment of farmers & processors</p> <p>.</p> <p>Stable political environment</p>
<p>3.0 Sweet potato based income-generating opportunities created for resource poor youth and women</p>	<p>3.1 At least 5 profitable sweet potato fresh root and processing enterprises identified and developed with 5 farmer groups and 5 processor groups by the end of the 3rd quarter of year 2.</p> <p>3.2 At least 50 % of the farmer and processor groups trained in enterprise establishment and management, acquire and use post harvest technologies to access markets with value-</p>	<p>Project reports</p> <p>Established pilot sites</p> <p>Training synopsis</p> <p>Field reports</p>	<p>Favourable prices for sweet products prevail</p> <p>More profitable commercial enterprises for farmers and potential processors will not affect their participation in the project.</p> <p>Target groups are enthusiastic and adopt new technologies.</p>

<p>4.0 An institutional mechanism that empowers poor farmers and rural processors to participate in SP technology and knowledge innovation systems (TKIS) developed</p>	<p>added products by the end of the project.</p>		<p>Target groups have access to micro-credit institutions</p>
	<p>4.1 At least 50 formed farmer groups composed of mainly small-scale sweet potato producers and processors registered through the coalition partnership by end of 2004.</p> <p>4.2 A self-sustaining coalition of relevant stakeholders (farmers, researchers, processors, NGOs, service providers, schools etc) put in place by the end of 2004.</p> <p>4.3 At least 50 farmer and processor groups aware of the available credit and development grant sources (such as project donor funding, NAADS, micro finance), and loan and grant acquisition requirements by November 2004.</p> <p>4.4 Mechanisms for dissemination of sweet potato post harvest knowledge and technologies to rural communities developed by the end of year 3 (or project life)</p>	<p>Workshops</p> <p>News letters</p> <p>Meetings</p>	<p>Full commitment of farmers & processors</p> <p>Staff at partner institutions do not change jobs.</p> <p>Researchers develop new post harvest technologies</p>

Activities	Responsible partners	Other partners	
1.1 Collect and document production information including production systems, average acreage, varieties yield, number of farmers, price and constraints to production and accessing markets.	BUCADEF	FOODNET	
1.2 Conduct market input analysis to select areas / sites where sweet potato processing is promising.	KARI	BUCADEF, FOODNET	
1.3 Conduct market surveys to establish and document the state of the current markets for fresh sweet potato root and processed products and their potential to absorb more sweet potato.	FOODNET	HORTEXA, BUCADEF KARI	
1.4 In collaboration with urban food enterprises, conduct feasibility and acceptability trials of new sweet potato products to Identify new market opportunities for processed sweet potato.	KARI	MAK-FST, FOODNET	
1.5 Mobilise and sensitise farmers and rural processors to create awareness on markets and market requirements and identify interested farmer and processor groups.	BUCADEF	HORTEXA, KARI	

1.5 Farmer groups negotiate and agree on terms of transaction (supply, payment and transport) of sweet potato with identified institutional markets.	BUCADEF	HORTEXA, FOODNET KARI, PRAPACE	
2.1 Document combined post harvest knowledge from CPHP/CIP/PRAPACE/KARI outputs	CIP	PRAPACE, KARI, FOSRI, CIP, NAARI, MAK-FST	
2.2 Conduct participatory demonstration trials to select suitable post harvest technologies (varieties, storage structures, post handling, preservation and processing technologies, including trial shipments) that meet market needs and farmers' & processors' preferences.	KARI	NAARI, CIP, FOSRI, MAK- FST, BUCADEF, HORTEXA, NRI	
2.3 Develop user-friendly packages for dissemination of technical knowledge and selected post harvest technologies	CIP	PRAPACE, KARI, NAARI, FOSRI, MAK-FST	
2.4 Train trainers (extension agents, group leaders, school teachers) on post harvest technology	PRAPACE	MAK-FST, FOSRI, NAARI, KARI, NRI	
2.5 Select and organise interested farmer groups for registration	BUCADEF	HORTEXA, KARI, PRAPACE	

2.6 Using the developed user-friendly packages, train the registered farmer groups on safe and effective use of post harvest technology to access and meet market requirements.	BUCADEF	HORTEXA, KARI, CIP FOSRI, MAK-FST	
2.7 Establish sites in selected schools for demonstrating improved selected post harvest technologies (storage, processing and handling technologies).	BRIBTE	KARI, CIP, NAARI, FOSRI, MAK-FST	
2.8 Identify and train interested persons in schools on dissemination of post harvest technologies & knowledge	BRIBTE	KARI, CIP, NAARI, FOSRI, MAK-FST	
3.1 Establish pilot sites to provide focal point to assess the technical feasibility and profitability (cost-benefit analysis) of post harvest technologies (storage, handling, packaging, processing) within a market driven frame work	KARI	FOSRI, MAK-FST, HORTEXA, BUCADEF, NAARI	
3.2 Based on the problems identified with the technologies and procedures for marketing, refine the handling, storage, packaging, processing methods and marketing approaches	KARI	FOSRI, MAK-FST, HORTEXA, BUCADEF, NAARI	
3.3 Establish a code of conduct to define methods of operation of enterprises to profitably meet market requirements.	HORTEXA	FOSRI, MAK-FST, HORTEXA, BUCADEF, NAARI	

3.4 Train groups interested in enterprise establishment in how to access markets with value-added products.	BUCADEF	FOSRI, MAK-FST, HORTEXA, CIP, NAARI	
3.5 Conduct workshop to link the farmers / processors to credit and grant institutions	BUCADEF	HORTEXA, FOODNET	
4.1 Form new sweet potato farmer groups in the target districts	BUCADEF	HORTEXA, PRAPACE	
4.2 Identify other potential partners and conduct an inaugural workshop to set rules to guide the partnership	PRAPACE	All partners	
4.3 Set up an information system to update members on new technologies	PRAPACE	BUCADEF, CIP KARI, NAARI, FOSRI, MAK-FST	
4.4 Provide technical backstopping for post harvest technologies & acquisition of funds	CIP	PRAPACE, KARI, CIP, NAARI, FOSRI, MAK-FST	

7.3 Annex III : Projected work plan

Proposed strategies / work plan for adopting project outputs to improve impact of the project, strengthen linkages among partners and ensure sustainability.

- a) Strengthening the coalition project which is transforming into sweetpotato development association
 - Registration of association to make it a legal entity
 - Organise a general meeting and election of executive committee
 - Recruitment of new members
 - Develop strategic work plan
- b) Scale up of research activities
 - Conduct more agronomic studies (effect of planting density, time of harvesting, and different varieties) to improve the market attributes for fresh sweetpotato and those on the effects of dehaulming and curing on quality of fresh sweetpotato roots before results are validated for adoption by farmers
 - Pursue export of sweetpotato by sea to enable farmers to benefit from it.
 - Develop and distribute user-friendly materials on post harvest technologies
 - Conduct cost-benefit analysis over a longer period of time to capture seasonal variation and therefore be able to recommend ways of improving the economic variability of various sweetpotato enterprises
 - Conduct more research to improve quality and marketability of sweetpotato processed products
 - Continue updating the sweetpotato website
- c) Increasing awareness of sweetpotato post-harvest technologies
 - Sensitisation of the public through radio and TV programmes by members of the executive (messages should target politicians, local leaders, farmers, policy makers, youth)
 - Writing articles in the newspapers
 - Members to use such fora as meetings / workshops organised within institutions to talk about the association and its activities
 - Members to integrate some of coalition activities in their departments/section/individual work plans
 - Participation in trade shows
 - Organise and conduct talks on post harvest technologies and marketing in schools/formation of students clubs.
 - Develop modal farmers who promote post harvest technologies
- d) Strengthening linkages
 - Broaden areas of collaboration with existing farmers
 - Increase partner organisation's participation in the association activities
 - Develop an inventory of organisations with similar objectives as the association or which promote post harvest technologies
 - Communicate and initiate collaborative linkages
 - Share and exchange information and or organise field visits
 - Develop or organise projects
- e) Mobilizing resources

- Develop joint projects with local governments to tap into local resources of funding e.g. PMA, LGDP, NAADS etc.
- Develop project proposals on development and dissemination of post harvest technologies and market them to interested donors
- Identify and make contacts with interested development partners/donors in post harvest technologies and marketing for joint implementation of projects

7.4 Annex IV: Summary minutes for coalition and task force meetings held during project implementation

30/10/2002 – The meeting was held for a briefing from the NRI officer about outputs of NRI and how they could be applied in the project, to develop expected outputs and identify activities for the project, clarify on emerging issues and set agenda for another meeting. Costs that would be involved if an NRI officer participated in the project either as a partner or on contract basis were discussed.

1/11/2002 - The NRI officer presented the costs that would be involved in regard to participation by an NRI officer in the project as partner or consultant. This information was expected to guide the members to make decision on participation by NRI in the project. Members discussed the logical framework and commented on the districts targeted by the project.

7/1/2003 - Members discussed responsibilities, qualifications and remuneration for the proposed Project Officer who would assist the Managing Partner to coordinate project activities, management of project funds and reviewed comments from the DFID Programme Advisory Committee (PAC). Members were expected to revise budgets for activities and submit to the task group for review. The partner - BUCADEF, was requested to contact DFID office for clarification on the issue of documenting the project process.

14/03/2003 – Members received communication about DFID approval of Recruitment of a Project officer. They discussed the conditions for recruitment of the officer, location of Project office and the purchase of capital equipment and furniture for office premises. Activities for immediate implementation were identified among which was the inaugural meeting for the launch of project activities. Rules for issuing funds to partners for activities were stated. Members were reminded to submit contributions for the Monitoring and evaluation document.

15/05/2003 - Members received report that adjustments were made to the budget against milestones that were submitted, the Annual report was submitted, most of the funds released in the first quarter had been used to purchase capital equipment. Members were also informed that activities to mobilize and sensitize farmers and schools were already being conducted. Interviews for a project were conducted and suitable candidate selected. Members were encouraged (if possible) to obtain pre-financing funds from their institutions to implement project activities, since the DFID system did not pre-finance project activities. Coincidentally, they were informed that DFID office was still negotiating for pre-financing of project activities. Members identified roles for the field officer. Management and usage of the project vehicle was discussed at length, and partners agreed that they would cater for fuel and maintenance costs and the driver's day allowance. One partner sought clarification about activities on market surveys and establishing market linkages and how they would be conducted, which was given. New members were accepted to join the coalition, i.e. Enterprise Development Ltd. and the Luganda Language group. Two

partners were assigned to clear the errors in the milestones document and ensure that it were ready for submission by the specified date.

21/05/2003 – Members discussed the issue of receiving funds, of which they were informed that we could not receive funds for the project unless the activity milestones were submitted. The driver remuneration and conditions of contract were discussed. Issues of the previous meeting were further discussed. Members were reminded that we were expected to submit quarterly reports and issued with the guidance sheet (7) for completion of project inception report.

30/06/2003 – The meeting was held with the DFID Regional officers and the DFID Partnerships Advisor. Partners shared experiences and sought help and guidance for the coalition approach and institutional setting. The Partnerships advisor informed the members that the partnership approach was a positive development as it encouraged building on research knowledge and encouraged them to monitor key changes in behavior/policy, etc, in the course of project implementation.

18/07/2003 – During the meeting, partners were informed about the status of funding from DFID, and the project inception report submitted to DFID. Clarification was given about certain partner's roles in the coalition and it was proposed that partners should sit and set clear guiding rules for the coalition. It was agreed that all partners would brief the coalition about the progress of their activities during each review meeting. Partners were expected to submit activity reports to the project officer prior to the meetings, and were reminded to submit requests for funds.

18/08/2003 - Partners reviewed the progress of project activities, planned for a workshop, set guiding rules for the coalition and discussed constraints that affected partners' implementation of activities, including accessing funds. Since there were problems in understanding activities by some partners, it was agreed that partners responsible to a given activity would sit together, internalize project activities, agree for proper implementation and sort out any misconceived ideas.

29/08/2003 - The meeting was held to assess the progress of activities. A format for reporting was proposed and agreed on, following which partners presented the progress of their activities. Comments and questions followed each of the presentations. Partners agreed to correct issues that were not agreed upon in reference to activities. Meanwhile a workshop was being organized for the 'training of trainers'. The workshop budget was reviewed.

11/10/2003 – Issues discussed included the Monitoring and Evaluation (M&E) of project activities, whereby members were requested to review documents and forward comments. The DFID - Program Manager was expected to visit the coalition. Members decided on activity sites that he would visit. Members felt it was important to present coalition activities in the Regional Root crops workshop that was due to take place in Arusha soon. The project officer informed partners that Quarter 2 funds were already available and reminded them to give no excuse of delays in implementation of activities. Partners suggested mechanisms for management and proper use funds by partners for improved results. To avoid delays and problems in receiving funds from partner institutions, partners recommended to obtain funds directly form the Managing Partner's office. In addition the issue of quarterly reports, funding activities of trainers and training of farmers in M&E were discussed; Farmer groups to be trained and venues were selected. To fasten implementation of project activities, partners who did not yet receive funds would be pre-facilitated from other activity funds.

1/11/2003 - During the meeting the Project Officer reminded members to submit work plans for the quarter and informed them that Quarter II and Quarter III funds had been received. The DFID officer explained to the partners the purposes of "participatory monitoring" and how it would assist in tracking down achievements as well as citing problems. 2 farmers sponsored by DFID were expected attend the conference of the International Society for Root Crops that was due to take place in Arusha.

12/12/2003 – During the meeting partners presented quarterly reports and progress of activities was reviewed. They were reminded to submit technical and financial reports on time. BUCADEF was advised to take a step to resolve the farmers' complaints that had arisen and urged to sensitize and mobilize new farmer groups for project activities. Partners were advised to document all transaction they conducted or dealt in with farmers. They were reminded to prepare and submit work plans for the next quarter. A period for visit by the NRI consultant and activities that he/she would visit and give advice for improvement were suggested. Members were informed of and asked to prepare for the Regional coalitions workshop, the purpose of which was to share experiences by coalitions.

12/01/2004 The project Monitoring and Evaluation (M&E) reports were presented to the coalition, followed by comments and discussions. Partners were reminded to submit work plans for the quarter.

22/04/2004 - During the meeting, lead partners for the project activities were advised to hold joint meetings with co-partners for planning, etc. The Project officer requested partners to minute their discussions for record purposes. Partners were reminded to submit work plans for the Quarter. There With respect to problems that cropped from linking farmers to markets, farmers were advised to always process documents of transactions. BUCADEF was reminded to effect pending payments to farmers. The Project officer encouraged partners to work harder to accomplish project activities. Partners were called upon to commit some time to develop the pre-proposal that had been submitted to ADF into a project proposal.

23/04 2004 – The meeting was held to update stakeholders on progress of activities of the coalition and to streamline problems and misunderstandings that regarded non-payments and delayed payments to farmers. Several recommendations were made to avoid recurrence of similar problems in the future. The issue of contractual arrangements was discussed and a way forward for the coalition proposed.

1/06/2004 –

16/07/2004 – Members reviewed institutional histories and proposed areas for improvement. They were urged to consider key issues that farmers pointed in their work plans. Members also reported the progress of activities they had accomplished during the quarter. The meeting was informed of funding secured from NARO.

15/10/2004 – An official from a Company interested in export of sweetpotato discussed with the project officer experiences of the company and what would be required if sweetpotato was to be shipped form Uganda.

22/10/2004 – During the meeting members were expected to provide input to institutional histories, discuss a way forward for pending coalition activities among which was the shipment trial. In addition they were expected to plan for final project evaluation, discuss the use of remaining funds and the remuneration of support staff, as well as farmers' and processors' constraints. In light of the fact that there were

very limited funds allocated to the shipment trial, members recommended that the cost of the activity be scaled down on volume. In addition partners would continue to solicit funds from interested organizations and government institutions. Farmers complaints included the issue of non-payment, to which it was agreed, that funds be deducted from coalition partners responsible for the problem. The problem was referred to the next meeting.

3/11/2004 – A general meeting was held during which partners discussed a way forward for pending activities and utilization of remaining funds, project evaluation and solving farmers' complaints and processors' constraints. The Managing Partner gave clarity over emerging issues and problems that had led farmer partners to confuse the coalition and PRAPACE office. While addressing the issue of non-payments that the farmers experienced, the Managing Partner recommended payment subject to documentary evidence of transactions. The DFID Officer identified that the skill of handling transactions was still lacking among farmers to which she recommended training to fill the gap. Pending activities were identified and allocated tentative budgets by prioritization.

15/11/2004 – A task group assigned to review farmers debts gave feedback and recommendations with respect to pending debts.

29/11/2004 – The task group members identified gaps in the institutional histories. Modes to settle non-payment claims were also discussed. Following decisions from the general meeting held on 3/11/2004, the task group discussed pending activities and allocated funds accordingly.

15/12/2004 – Task group members assigned themselves tasks for completion of the Project Final report. Mr. Nsumba updated members about the progress in plans for the shipment trial. Members also discussed and agreed upon remuneration of staff at the Managing Partner's office. Clarification was given to Mr. Kelly Wanda pertaining re-allocation of funds to project activities.

13/01/2005 – During the meeting the way forward for the coalition the pending activity on shipment trial and the fate for farmers sweetpotato were discussed.

22/01/2005 – Mr. James Nsumba briefed farmers about of the outcome of the meeting held on 13/01/2005, during which the way forward for the coalition was discussed. Members also discussed what could be done to farmers' sweetpotato that had been produced for shipment. A pending activity on cost-benefit analysis was put across.

22/01/2005 – Members of the task group identified key pending activities, discussed the use of remaining funds and the way forward to solving farmers' constraint of sweetpotato. The task group came up with two options; to process farmers' sweetpotato and sell as dried chips, or to find buyers who would purchase the farmers' roots.

3/02/2005 – Task group members assessed consultants' application for cost benefit analysis and selected one who would carry out the study. They allocated budgets against pending activities and items.

7.5 Annex V: Mechanisms by which feedback on the process of the project among Partners was maintained

Table 4 Mechanisms (structures and processes) in place for the project partners to link with one another

	PRAPACE	BUCADEF	FOODNET	HORTEXA	NAARI	KARI	FOSRI	BRIBTE	MAK-FST	CIP	Farmers
PRAPACE		1, 2,3, 4, 5, 7, 8, 11	1, 2,3, 4, 5, 7, 8, 11	1, 2,3, 4, 5, 7, 8, 11	1, 2,3, 4, 5, 7, 8, 11	1, 2,3, 4, 5, 7, 8, 11	1, 2,3, 4, 5, 7, 8, 11	1,3,7, 8,	1, 2,3, 4, 5, 7, 8, 11	1, 2,3, 4, 5, 7, 8, 11,12	1, 5
BUCADEF	1, 2,3, 4, 5, 7, 8,		5,7,8,11	7,8,	5,7,8,11	7,8,9,11	5, 7,8,9,11	-	-	1,4,	3,4,5,7,8,10,11
FOODNET	"	1, 2,3, 4, 5, 7, 8, 11		7,8,						1,4	
HORTEXA	"	5,7,8, 10	5,7,8, 10							1,4,11	
NAARI	"	5,7,8,11								1,4,11,12	
KARI	"	7,8,9,11								1,4,	
FOSRI	"	5, 7,8,9,11								1,4,	
Maganjo Grain Millers	-									1,4	
BRIBTIE	1,3,4,7,8,									-	
MAK-FST	1, 2,3, 4, 5, 7, 8,									1,4	
TONNET	-									1,4,	
Farmers	1, 3, 4,7, 8,11	1, 3, 4, 10								1,4,11	

Key

1 = Scheduled meetings 2 = Urgent/adhoc meetings 3 = Email/Telephone 4 = Letters 5 = Joint implementation of activities eg planning together, visiting farmers together 6 = Steering committee 7 = Managing partner 8 = Project Field Officer 9 = Small task forces as need arises 10 = Radio –CBS 11= Field visit 12= Share office

7.6 Annex VI: Disseminated outputs

Publications:

- SWEETPOTATO COALITION PROJECT. (2004) Collaborative effort in the search for sweetpotato markets in Uganda. p.4. In: *Links: The News and Information Bulletin, Issue 3 (July)*. DFIDEA Natural Resources Research and Development Coordination Office, Kampala, Uganda.
- NAMUTEBI, A., NATABIRWA, H., LEMAGA, B., KAPINGA, R., MATOVU, M., TUMWEGAMIRE, S., NSUMBA, J. and OCOM J. (2004) Long-term storage of sweetpotato by small-scale farmers through improved post harvest technologies. *Uganda Journal of Agricultural Sciences*, **9** (1): 922-930.
- KATENDE, M., J. NSUMBA, R. KAPINGA, S. TUMWEGAMIRE, B. LEMAGA, and B. SERWADA. (2003). Linking farmers to export markets of fresh sweetpotato experiences from Uganda. p39. In: *13th Symposium of the ISTRC. Tropical root and tuber crops: opportunities for poverty alleviation and sustainable livelihoods in the developing world*. Tanzania Commission for Science and Technology (COSTECH), ISTRC, 10-14 November 2003. Arusha, Tanzania. [Abstract].
- NSUMBA, J., S. TUMWEGAMIRE, B. LEMAGA, R. KAPINGA, R.O.M.MWANGA, and B. SERWADA. (2003). Development of farmer based seed systems for increased sweetpotato production. p160. In: *13th Symposium of the ISTRC. Tropical root and tuber crops: opportunities for poverty alleviation and sustainable livelihoods in the developing world*. Tanzania Commission for Science and Technology (COSTECH), ISTRC, 10-14 November 2003. Arusha, Tanzania. [Abstract].

Internal Reports:

- SWEETPOTATO COALITION PROJECT (2003) Improving the livelihoods of small-scale sweetpotato farmers in Central Uganda through a crop post-harvest based innovation System. Inception report. Project R8273. PRAPACE, Kampala, Uganda, 20 pp.
- SWEETPOTATO COALITION PROJECT (2003) Improving the livelihoods of small-scale sweetpotato farmers in Central Uganda through a crop post-harvest based innovation System. DFID Crop Post Harvest Programme, Quarter 2 report, 2003/04. Project R8273. PRAPACE, Kampala, Uganda, 12 pp.
- SWEETPOTATO COALITION PROJECT (2003) Improving the livelihoods of small-scale sweetpotato farmers in Central Uganda through a crop post-harvest based innovation System. DFID Crop Post Harvest Programme, Quarter 3 report, 2003/04. Project R8273. PRAPACE, Kampala, Uganda, 15 pp.
- SWEETPOTATO COALITION PROJECT (2003) Improving the livelihoods of small-scale sweetpotato farmers in Central Uganda through a crop post-harvest based innovation System. DFID Crop Post Harvest Programme,

- Annual report, 2003/04. Project R8273. PRAPACE, Kampala, Uganda, 15 pp.
- SWEETPOTATO COALITION PROJECT (2003) Improving the livelihoods of small-scale sweetpotato farmers in Central Uganda through a crop post-harvest based innovation System. DFID Crop Post Harvest Programme, Quarter 1 report, 2004/05. Project R8273. PRAPACE, Kampala, Uganda, 13 pp.
 - SWEETPOTATO COALITION PROJECT (2003) Improving the livelihoods of small-scale sweetpotato farmers in Central Uganda through a crop post-harvest based innovation System. DFID Crop Post Harvest Programme, Quarter 2 report, 2004/05. Project R8273. PRAPACE, Kampala, Uganda, 11pp.
 - SWEETPOTATO COALITION PROJECT (2003) Shipment simulation study. Technical Report, Project R8273. PRAPACE, Kampala, Uganda
 - LEMAGA, B., SEKITTO, I. and NSUMBA, J. (2003) *Training of trainers' workshop of sweetpotato post-harvest technologies and marketing. Hotel Garden, Kampala, Uganda. Report of workshop. 1-3 September 2003.* PRAPACE, Kampala, Uganda (Three-day training workshop for 23 trainers).
 - NAMULONGE AGRICULTURAL AND ANIMAL PRODUCTION RESEARCH INSTITUTE (2004) Selection of varieties that meet both farmers' needs and market requirements in terms of post-harvest characteristics. Final technical report, Project R8273. Namulonge Agricultural and Animal Production Research Institute, Uganda. 6 pp.
 - SWEETPOTATO COALITION PROJECT (2004) Improving the livelihoods of small-scale sweetpotato farmers in Central Uganda through a crop post-harvest based innovation System. Monitoring and Evaluation report 2004/05. Project R8273. PRAPACE, Kampala, Uganda, 8 pp.
 - SWEETPOTATO COALITION PROJECT (2004) Improving the livelihoods of small-scale sweetpotato farmers in Central Uganda through a crop post-harvest based innovation System. Institutional History Report. Project R8273. PRAPACE, Kampala, Uganda, 13 pp.
 - LEMAGA, B., SEKITTO, I., NSUMBA, J., and KARUHANGA, M. (2004) *Review workshop for sweetpotato coalition project. Rider Hotel, Seeta-Mukono, Uganda. Report of workshop. 13 February 2004. 30pp.* PRAPACE, Kampala, Uganda. (One day workshop for 25 people).
 - LEMAGA, B., SEKITTO, I., NSUMBA, J., and KARUHANGA, M. (2004) *Final evaluation workshop for coalition project. Faculty of Forestry and Nature Conservation, Makerere University, Kampala, Uganda. Report of workshop. 16 -17 December 2004. 66pp.* PRAPACE, Kampala, Uganda. (Two day workshop for 40 stakeholders)
 - LEMAGA, B., SEKITTO, I., NSUMBA, J., NATABIRWA H, NAMUTEBI A, OWORI C, AND TINDIWENSI, C. (2005) Cost benefit analysis of sweetpotato on farm enterprises in central Uganda. 28pp. PRAPACE, Kampala, Uganda.

- KEITH, T. (2004) Report on a visit to Uganda regarding Inputs by NRI on R8273. 29 March – 1 April 2004. 13pp

6. Other Dissemination of Results:

- SWEETPOTATO COALITION PROJECT (2003) Proceedings of the training of trainers' workshop on sweetpotato post harvest technologies and marketing. 33 minutes. 5 copies. Peka Productions (Eds). Kampala, Uganda. (Field): Farmers, Processors, and Schools). (Video)
- SWEETPOTATO COALITION PROJECT (2003) Improving the livelihoods of small-scale sweetpotato farmers in Central Uganda through a crop post-harvest-based innovation system. *Thirteenth International Symposium of the Roots and Tuber Society, Arusha, Tanzania, 3-5 November 2003*. PRAPACE, Kampala, Uganda (Poster)
- LEMAGA B., C. NSUMBA, C. NIRINGIYE, B. ODONGO, S. TUMWEGAMIRE, R. KAPINGA, A. NAMUTEBI, C. OWORI, and R.O.M MWANGA. (2004). Improving the livelihood of sweetpotato farmers in Uganda through partnership. *The McKnight Foundation's Collaborative Crop Research Program (CCRP) conference "From Partnerships to Community: The Arc of Change on 6-10 November 2004" in Vaals, The Netherlands*. (Poster)
- SWEETPOTATO COALITION PROJECT (2004) Sweetpotato, a treasure crop in Uganda 2004. 1000 copies. PRAPACE, Kampala, Uganda. (Calendar) (Field) (English)
- INTERNATIONAL POTATO CENTER (2004) An exhibition of sweetpotato and its value added products by farmers to members of parliament during their workshop with CGIAR centers in Nile Resort, Jinja, Uganda. 19 February 2004.
- SWEETPOTATO COALITION PROJECT (2004) Nutritious porridge flour: Nutritional value and ingredients. 1000 copies. PRAPACE, Kampala, Uganda. (Information leaflets)
- SWEETPOTATO COALITION PROJECT (2004) www.sweetpotatocoalition.org. [website] [English and Luganda]
- UNITED KINGDOM DEPARTMENT FOR INTERNATIONAL DEVELOPMENT/HORTICULTURAL STRATEGIC INTERVENTION PROGRAM (2004) Sweetpotato varieties for food security, health, local and export markets. 1000 copies. Sweetpotato coalition project, Kampala, Uganda. 11pp and 14pp. [Training manual] [English and Luganda]