Post-harvest Challenges in Sweetpotato: NRI partnership with CIP to support SASHA2

Andrew Westby, Tanya Stathers, Andy Marchant, Ilaria Tedesco, Aurelie Bechoff, Richard Fuchs, Debbie Rees
A new emphasis was introduced into SASHA at stage 2

*Improve the utilization pathways for SP consumption and production to boost the economic viability of SP value addition and business activities*

*Alleviate vitamin A deficiency through intake of processed products containing OFSP.*

CIP envisaged that storage and handling would be important issues and therefore NRI was brought in to join the team.
NRI has worked with CIP on postharvest issues of sweetpotato for several decades

Examples:

• Study of simple on-farm storage structures (Uganda)
• Understanding varietal characteristics associated with storability
• Triple S system for storing seed
• Understanding retention of carotenoid during processing and storage
NRI has also worked on consumer acceptance of OFSP which is central to SASHA

Consumer preference is important in the value chain but often neglected regarding poor people. Information about preference and markets can increase the success of a new more nutritious varieties or safer products.

NRI has explored preferences and willingness to pay of biofortified sweetpotato and cassava. Language and education were initially a challenge.

For example: new vitamin A orange sweetpotato in Uganda was liked by 82% of consumers but 18% did not. Clear rural / urban differences.

Increasing demand to understand preference. Challenge is diverse varieties and products but lack of knowledge about markets and demand.
NRI inputs to SASHA 2

- COMMERCIAL SCALE STORAGE  To develop cost-effective technologies to enable commercially oriented farmer organizations to supply quality sweetpotato roots year-round to specific agro processors or urban markets (NRI LEAD)

- DOMESTIC SCALE STORAGE  To assure year-round supply of orange-fleshed sweetpotato in nutritionally at risk households, develop convenient and low-cost methods for fresh root storage (NRI SUPPORT)

- ANALYTICAL SUPPORT  To develop the regional capacity and appropriate protocols for analysis of roots and derived products at reasonable cost to ensure that they have adequate nutritional quality and meet safety standards. (NRI SUPPORT)
Commercial scale storage
In order to identify opportunities to expand marketing of fresh and processed OFSP a value chain analysis and fresh root storage feasibility study was undertaken in Kenya:

*Tanya Stathers, Ilaria Tedesco*

- fresh SP root production, availability, trading and service provision in main production areas (Homa Bay, Migori, Siaya, Busia, and Kericho - Green)
- fresh SP root trading, retailing and consumption in major urban markets (Nairobi, Nakuru and Kisumu - Yellow)

**Key questions**
- Is OFSP puree production feasible?
- Is storage feasible/advantageous?
Complex volumetrics of SP value chains

Flat-sized sacks of SP delivered by farmer to roadside, Kabondo

Prim-sized (extended) sack of SP being packed at Kabondo for trade to Nairobi

Tight packing of SP roots

1 punda (donkey) = 2 moets (one each side)

‘Tolit’ bucket. 4 Tolits = 1 moet, Kericho

Prim-sized (extended) sacks of SP waiting for porterage at Nairobi’s Muthurwa market

Bao-sized sacks (2 and a bit sack length) of SP at Nairobi’s Muthurwa wholesale market

Kiptere trader showing profit margin of resizing the ‘moet’ volume between purchase and sale.

Photos: T Stathers, NRI

Knowledge to feed the world
Value chain analysis and fresh root storage feasibility study in Kenya

• Kenya’s population is growing and becoming increasingly urbanised.

• Sweetpotato is important for urban populations as it is easy to prepare and nutritious

• Area of production for sweetpotato increasing relative to other crops
Value chain analysis and fresh root storage feasibility study in Kenya

- An exciting business opportunity to produce OFSP puree for inclusion in Vitamin A rich bakery products in one of Kenya’s large supermarket chains, was identified by CIP in 2014.
  - Analysis within VCA indicated that supply of SP for this could be provided by
    - Well organised scheduling and staggering of OFSP planting (see table below)
    - Use of storage facilities at production site able to store 1 month’s supply of OFSP (capacity 20 – 30 tonnes)
  - Investment in appropriate storage facilities cost effective where increase in price in low season by 20% or greater

### Table A. Varying supply seasons of fresh SP roots in Busia, Homa Bay, Migori, Siaya and Kericho counties

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Key: *** = Peak supply; ** = Medium supply; * = Low supply

Source: Field visits
To ensure sweetpotato supply for puree production for Kenyan enterprise we focused on three issues

- Improve strategies for sweetpotato handling
- Optimise short term storage
- Optimise long term storage (at least 2 months)
Improve strategies for OFSP handling and short term storage: August 2015 Trial on strategies for sweetpotato handling for short term storage (up to 14 days)

Treatments included in trial

- Harvesting method - ox plough, hand
- Methods of soil removal - wet brush, dry manual, wet manual, no removal)
- Packaging - Plastic crate, wooden crate, sack
- Variety - Kabode, Vita

Main findings
Manually wash, air dry, sacks to transport, sort
Sack storage was better than all other treatments due to high humidity
This underlines the importance of curing (maintaining roots at high humidity after harvest to allow healing of wounds)

Further handling trials will be conducted once storage conditions have been optimised.

Tanya Stathers, Penina Muoki, Bethwell Kipkoech, Olivia Wahonya, Jan Low, Tawanda Muzhingi, Andrew Marchant, Debbie Rees
More information in flyer
Long-term OFSP storage

Objectives

• To ensure that puree production is not constrained by root supply, we need cost-effective storage facility, capable of storing for at least one month.

• Requirements
  • Low cost (for construction of store, power supply installation, running costs, including power consumption and maintenance)
  • Reliable independent of the national electricity grid e.g. use solar power
  • Capable of maintaining storage temperatures (ideally 15 - 17°C)
  • Capable of maintaining temperatures for curing at start of storage
  • User friendly to run, and to repair

• To be written up as a case study to inform subsequent ventures, including a set of plans for store construction.

Storage construction led by Andy Marchant,
Trials support from Benard Otieno, Bethwel Keochi, Penina Muoki
Long term OFSP storage Progress

• Two storage rooms have been constructed within an existing processing facility
• (In future newly constructed buildings will facilitate the process)
An evaporative cooling system has been developed with low installation costs and low power demand to allow the use of an alternative power supply such as solar power, and using existing 12v components.

An initial challenge was shortage of meteorological data, especially lack of information on solar radiation through the year. A light meter with data logger has been installed, and number of solar panels increased to provide sufficient power.

The cooling system is currently working at 70% efficiency, but we are working to increase efficiency and to improve temperature reduction.
Long term OFSP storage
Results of trials on sweetpotato using facilities constructed

**Trial 1**
- indicated that heating was required to achieve the temperatures necessary for optimum curing (28 - 32 °C)

**Trial 2**
- Two varieties, Kabode and Vita, stored each washed and unwashed.
- Curing (with heating to achieve 28 – 32 °C and high humidity achieved for reducing ventilation) was carried out for 4 days, followed by cooling with the evaporative system.
- Inefficiencies of the evaporative cooling system meant that the storage temperature was above 20°C (typically 20 - 25°C) while 15-17 °C would be optimum
- Despite higher than optimum temperatures after 4 months, >80% original weight of good quality roots that provided good quality puree
- Washing may increase rots, but this needs to be rechecked

Fresh and cooked roots after 4 months storage
Longer term OFSP storage Challenges

• Trial 3 identified two important challenges
  • Mechanical breakdowns underlined need for user friendly controls and a problem solving checklist for facility users.
  • *A user friendly control system has now been developed, and checklist is in process.*
• Weevil infestation of the stores which was not great in the first trials has become a greater problem than anticipated, as complete control of weevils during production is not feasible.
  • *Lower temperature storage should help reduce this problem.*
• We are recommending that stores are completely emptied at regular intervals and fumigated.
Other NRI inputs to SASHA

- Construction of store for puree at Kisumu
- Value Chain analysis in Mozambique
- Advice on potential for storage in Mozambique
- Consultation on methods of vitamin A analysis
- Support for development of protocols for food safety tests on OFSP products
NRI inputs for Year 3

- Final development and testing for two sweetpotato stores at Organi site at Kisumu
- Complete construction of puree store at Kisumu
- Final root storage trial within completed/tested storage facilities
- Follow up Postharvest handling trial in Kenya
- Optimise household/small scale commercial storage facilities in Ghana
- Dissemination material for Triple S storage in Kenya
- Provide support for development of appropriate training in hygenic practices for processors and microbial challenge tests on OFSP puree