ABOUT THE ABUKET SWEETPOTATO FARMER PROCESSORS

Abuket Sweetpotato Farmers Association was formed in 2002 by graduating members of Sweetpotato Farmer Field Schools interested in piloting commercial chipping of orange-fleshed sweetpotato with the aim of selling to millers for production of pro-vitamin A composite flour mixtures. The group has expanded from its original 21 to 35 (22 men and 13 women) member. In addition, some of its old members have formed 2 other groups upon acquiring a second chipper. They are pursuing registration as Kyere Farmer Facilitations Savings and Credit Association to train other farmers.



Experiences in Quality On-Farm Sweetpotato Processing

30 MAY 2005



Abuket Sweetpotato Processors, Soroti, Uganda

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FOUNDER MEMBERS OF ABUKET SWEETPOTATO PROCESSORS' ASSOCIATION

No.	NAME	GENDER	PARENT FFS	DESIGNATION
1	Ekinyu Eugene	M	Abuket	Chairperson
2	Obaren Patrick	M	Apaa Mora	Vice Chairperson
3	Eyatum Mordecai	M	Abuket	Secretary
4	Akello Christine	F	Abuket	Treasurer
5	Amati Mary	F	Abuket	Sales person
6	Onyait Gabriel	M	Abuket	Purchasing agent
7	Eloku Joseph	M	Okunguro	Quality Inspector
8	Oile Charles	M	Eketakinos	Member
9	Aluka Stella Rose	F	Abuket	Member
10	Ogwang Geofrey	M	Okunguro	Member
11	Opio-Epyaka Charles	M	Abuket	Member
12	Agwang Modesta	F	Abuket	Member
13	Opolot Robert	M	Okunguro	Member
14	Oule Alex	M	Akisim	Member
15	Odeke Michael	M	Apaa mora	Member
16	Ocom Betty	F	Eketakinos	Member
17	Atigo Janet	F	Akisim	Member
18	Apolot Rose	F	Eketakinos	Member
19	Atai janet	F	Angole	Member
20	Abiyo Ketty	F	Angole	Member
21	Otim William	M	Angole	Member

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FOREWORD

This handbook presents experiences of farmers from Abuket Sweetpotato Processors Farmer Field School (FFS) in Kyere Sub- county, Soroti district, Uganda. The farmers had previously participated in a sweetpotato FFS in which they intensively learned about various aspects of sweetpotato production, post harvest handling, processing and utilization under the integrated crop management approach. Subquently in 2002, after completion of the long season training, the group initiated a sweetpotato chipping enterprise, and one ton of chips that was readly sold to Maganjo Grain Millers provoked into increased interest in production of sweetpotato chips. However, in 2003 despite production of 12 tons, Maganjo Grain Millers declined to purchase the chips. As an alternative, farmers were linked with Kasawo Grain Millers, a sweetpotato miller, through Kawanda Post Harvest Programme, who were able to purchase one ton per month.

Evidently farmers lacked techniques of producing quality standard chips acceptable by secondary processors. In response, the Soroti District Local Government, in collaboration with the National Agricultural Research Organisation (NARO) and the International Potato Center secured funding from the NARO-DFID Client Oriented Agricultural Research and Development (COARD) Project based at Serere Agricultural and Animal Production Research Institute (SAARI), Serere to provide training to the farmers to enhance their skills in quality sweetpotato processing. Initially, two extension officers were identified by the Soroti District Agricultural Office to undergo a one-week tailored training of trainers (ToT) course on sweetpotato postharvest handling and processing.

A specialized training for the farmers using the Farmer Field School approach that followed attracted 35 farmers despite the initial target number of 20 participants. It was clear that many more farmers were interested in participating in the FFS. The training was aimed at equiping farmers with improved skills in quality processing of sweetpotato. The course included training on quality assessment and assemblage of protocols for production of high quality chips and sweetpotato flours/ pastry products.

Farmer-based composite flours for porridge, local bread and other recipes at community household level were developed by recipe trial combinations using the knowledge gained from the participatory trainings and selected incorporations of traditional processing approaches on sweetpotato post harvest handling and processing.

D). Selected pastries and juice

Ingredient	Crackies or Swallis	Chapattis	*Juice
Sweetpotato flour	1 kg	1 kg	1 kg (boiled or mashed)
Baking flour	2 kg	2 kg	100 g (optional)
Sugar			1 medium fruit
Lemon			
Salt	2 table spoonfuls	2 table spoonfuls	–
Cooking oil	0.7 litres	0.5 litre	–
Hot chilies	8 pods	–	–
Onion or Garlic	4 medium bulbs	–	2 litres
Water	–	–	100 mls
Pineapple juice	–	–	12 hours
Shelf life	3 weeks		

*Boiled before packing

E). Recipes being piloted without definite proportions

Crisps	Soap	Poultry feeds	Relish
Fresh or chips	Residue from juice	Sweetpotato rejects	Sp leaves + Soda ash
Cooking oil	Animal fat	Maize bran	- and /or
Salt	Salt/soda ash	Sunflower cake	G/nuts
-	Sodium hydroxide	Sorghum	Sour milk
-	Perfume additive	Salt	cooking oil
-	Colour additive	Fish	*Additives
6 months shelf life		Greens	
		Soya meat	
		Bone Meal	

*Additives include:- Tomatoes, Onions, Mushrooms

Annex 1: Examples Farmer-Developed Recipes

A) **Porridges (kg) P1, P2, and P3 are alternative porridge composites formulations**

Ingredient	P1	P2	P3
Sweetpotato flour	2	2	2
Maize	1	-	-
Soya bean	0.5	0.5	0.5
Cassava	0.5	0.5	0.5
Millet	-	1	-
Sorghum	-	-	0.5
Additives	Recommended	Recommended	Recommended
Sugar	Optional	Optional	Optional

Additives include Tamarind, lemon and young dried and pounded mangoes. May be optional for consumers with ulcers. An extract is made and either mixed in boiling water before the flour is mixed or added individually during consumption.

B) Local Bread (%) B1-B3 are alternative bread composite formulations

Ingredient	B1	B2	B3
Sweetpotato flour	100	48	60
Cassava	-	48 (fermented)	30 (Not fermented)
Sorghum	-	4	
Millet	-	-	10
Additive	Highly recommended	Highly recommended	Highly recommended

N.B: Fermented cassava has less starch

C) Other processed product recipes

Ingedient	Doughnuts	Half Cake	Cake
Sweetpotato flour	1 kg	1 kg	0.5 kg
Baking flour	2 kg	2 kg	2 kg
Yeast	1.5 table spoonfuls	_	_
Sugar	300 g	300 g	0.5 kg
Lemon	0.5 medium fruit	0.5 medium	I medium fruit
Salt	1.5 spoonfuls	-	_
Baking fat	4 table spoonfuls	-	_
Cooking oil	1 litre	1.5 litres	_
Milk	_	1.5 litres	_
Baking powder	_	100 g	100 g
Blue band	_	-	250 g
Eggs or milk	_	-	4 eggs or 0.5 litre of milk
Shelf life	7 days	7 days	7 days

Fermented cassava has less starch.

To date Abuket sweetpotato processors, besides, supplying high quality chips to secondary processors, produces a number of flour mixtures for local bread and porridge preparations, and produce household pastries including cakes chapattis, crisps and doughnuts for local supply to the shops and eating places within Kyere sub-county, Soroti district. Abuket has become a successful association recognised by many community-based organizations.

It is hoped that the information in this booklet will be useful to other sweetpotato farmers interested in improving the quality of their produce and will enhance value addition by farmers towards income generation for food security. The Abuket paradigm has demonstrated that farmers are able to, with the right capacities, add value to sweetpotato produced and better their livelihoods.

Dr. L.K. Serunjogi
Director SAARI

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Many thanks to (GTZ) for meeting the cost of ISBN number that was obtained through the department of Agricultural Extension Makerere University, and for supporting the printing of more copies of this booklet for wide dissemination.

Other products from sweetpotato





Left: Sweetpotato relish can be taken with rice, posho or millet bread (Atap)

Bottom Left: Sweetpotato juice





Left: Sweetpotato crisps (deep fried)

Bottom Left: Sweetpotato porridge. Composite flour is also available for Atap.

Sweetpotato Processed Products



Sweetpotato doughnuts (deep fried)



Baked SP *chapattis*



Baked sweetpotato cake



Sweetpotato crackles (deep fried)



Sweetpotato half-cake (deep fried)



Boiled sweetpotato roots

Introduction

Importance of sweetpotato

Sweetpotato is ranked seventh among the food crops produced in the world and has an annual production of 138 million metric tons. The crop is most common in the food systems of the countries surrounding Lake Victoria. Uganda is the world's second largest producer after China. Sweetpotato is second to cassava as the most important food crop in Soroti district in Uganda where it is traditionally eaten in several forms including chewing fresh roots, boiled, dried, sliced, and milled into either sole or composite flours. Although, sweetpotato has on the whole been grown on smallhold farms, as a secondary food crop by rural subsistence farmers, in many areas of the country it plays a role as a food security crop, available when other foods run short or in years of drought or other catastrophes. Many varieties and land races are grown but most of them are white or cream-fleshed, and supply little or no pro-vitamin A. Recent introductions of orange-fleshed varieties are providing a low-cost, easily available, natural, dietary source of pro-vitamin A. This micronutrient is critically deficient in the diets of many rural people in Africa, particularly young children, and often results in blindness and even death in severe cases.

Sweetpotato processing

The quality of sweetpotato chips is influenced by many pre- and post harvest factors including inherent cultivar factors i.e. environmental factors such as light, wind and rainfall; and cultural conditions such as method of chipping. Sweetpotato processing has an important role to play in both sustainable food supply and reduced loses through extended storage shelf life. Proper drying, packaging and storage can increase the shelf life of sweetpotato chips by reducing the degradation of vitamin A by ultra-violet light; minimize vulnerability to fungal decay and notorious storage weevils and boring insects. Processing paves way to wide utilization choices of sweetpotato to consumers and improves access to markets by providing a multiplicity of composite products and forms of preparations using appropriate technologies. This would lead to a change in the mis-leading attitude that sweetpotato should be eaten when other preferred foods are scarce or during periods of famine. Thus, processing of sweetpotato (SP) roots to dry SP chips is a food processing operation which will require every individual in the process to be responsible for the quality of his/ her work (that is at each stage of the process), hence the concept of total quality management (TQM).

Table 1: Differences between the sun and solar drying techniques*

Sun Drying	Solar drying
Low hygiene quality, especially if drying is done on the ground	High hygiene quality. Drying occurs in an enclosure and chips are raised off the ground
Low nutritive value (beta-carotene content)	High nutritive value because certain sun rays are prevented from reaching the product
Orange colour intensity reduced	Appearance/ colour brighter & intense orange due enclosure preventing loss of carotenes
Chips may be easily contaminated with extraneous matter	Low chances of extraneous matter getting I into contact with extraneous matter

*Both depend on solar energy and weather pattern, with the exception of a few solar dryers.

Table 2: Expected Fresh: Dry weight ratio of roots of selected varieties

Variety	Fresh root weight	Dried chips
Ejumula	5	1.62
Kakamega	5	1.77
Dar-es-Salaam Carrot	5	1.00
Esapat/Kala	5	1.53
Araka white	5	1.50

Step 6: Conditioning Sorting and grading

Conditioning helps to dispel off excess heat and is done by pouring or heaping the freshly dry chips on clean floor under open-walled shade for 24 - 48 hours. After conditioning the chips are sorted for uniformity by removing foreign materials and rejects before packaging or further processing.



Above: Sorting and packing of conditioned

Table 5 shows the importance of a series of factors in ensuring production of high qualit y SP chips.

Table 5: Quality Assurance Factors (QAF)

Factor	Purpose
Vine selection	Right variety planted
Field pest and disease management	Health roots
Sorting and trimming	Discard infected portion
Washing roots or peeling	Clean off the unwanted contaminants
Machine chipping	Ensure uniformity of slices and faster drying Minimise loss of Vitamin A during storage
Raised drying racks	Minimize contimination
Black packing material	Minimise loss of Vitamin A during drying
Solar drying	Minimise loss of Vitamin A during drying
Storage	Avoid build up of pests and fungal pathogens
a) Ventilated store	due to moisture
b) Use of wooden pallets	Avoid absorption of moisture from the floor

Key aspects of Quality

However, the desired characteristics of high quality sweetpotato chips are;

1. Appearance: uniform thin slices (10 mm) and colour intensity
2. Free from defects such as skin planks
3. Evenly dried
4. Long storage shelf-life
5. Free from filth or extraneous matter such as dust, soil, insects or moulds, urine and droppings or hair
6. Free from off-types or mixed varieties



Above: Local drying of sweetpotato chips on ground pre-smeared with cowdung



Above: Local process; crushing on stone



Farmer to farmer orientation to mechanical sweetpotato processing

Step 7: Packing and weighing



Above: Packing and weighing SP for storage

Sweetpotato chips can be packed in clean sisal or polypropylene sacks or bags. The use of black packaging material (e.g. two black linings inside a sisal sack) helps to minimise the loss of vitamin A (which easily degrades when exposed to ultraviolet light) during storage. Sweetpotato flour can also be safely packed and stored in baskets, tins, basins and pots. Packing material especially sacks and bags must be clean and not previously used for any purpose (should be new).

Step 8: Storage

Proper packaging facilitates presenting the dry SP chips in an acceptable condition on the market or enables the chips to arrive on the market in unchanged condition, and acceptable to consumers. Storage postpones use and facilitates hoarding for better market price. Regular monitoring of the stored products should be undertaken to build up knowledge about the products shelf life under specific storage conditions and prevent infestations of insects or rodents developing.

Step 9: Labeling

Packages should be labeled to trace the origin of the product. If compositional or nutritional information is needed this will require that a sample of the dry sweetpotato chips are analysed to give a representative content per consignment or batch. Parameters to label include code number, name and description of the product, weight or number of pieces, name and address of consignee, date of processing, storage direction, and direction for preparation.

Step 10: Grinding

The grinding process facilitates utilization and development of recipes. After drying, the sweetpotato chips can be milled into flour either by locally pounding or using powered mills.

A number of basic tools are involved in sweetpotato processing. Their respective uses are outlined in Table 3. Table 4 presents recommendations for key facilities in production of quality SP chips.

Table 3: Basic tools and materials for on-farm sweetpotato processing

Tool	Importance
Washing drum/ basins	Washing the roots before chipping
Knives	Trimming off the unwanted parts of the roots
Black polythene sheets	Preferred for drying because it absorbs heat and conserves orange-fleshed color
Packaging material	Preserve desired characteristics

Table 4: Facilities for on-farm sweetpotato processing

Facility	Considerations
Receiving and Preparatory yard	Adequate shade should be constructed for receiving (weighing and off-loading) the roots and an area for cleaning the roots due processing. Should be hygienic, free draining with adequate water supply for washing the roots and tools used. Provision should be provided for prompt disposal of rejects (Step 2)
Drying area	The drying tray should be raised 1 m off the ground to prevent dust and dirt contaminating the chips. Black polythene should be laid on the drying flat on which the chips are spread.
Conditioning and sorting area	Adequate flour space preferably shelter with semi-open walls should be constructed for sorting out the unwanted materials, especially the planks from the fresh dry chips, and allowing gradual removal of heat within 48 hours before packing. (see plate - step 6)
Storage	The store should ensure free air circulation and be leak proof to avoid moist condition that would result into build up fungal and other microbial organisms. Wetting and drying of chips results in deterioration through swelling when they absorb water and shrinking due to a moist store. The walls and floor should be smooth to avoid cracks that would provide sanctuary for storage insect pests and vermin. Wooden pallets/ platforms can be used to stack the packed sweetpotato products on to prevent moisture being absorbed from the floor. The store should not be located in close proximity to fire prone places as a preventive measure against fire disaster. Avoid over-stocking in the storehouse and there should be passages for regular inspection during storage. Avoid pesticide toxicity and seek advice before application

Advantages of Quality Processing

Below are some advantages of sweetpotato processing:

1. Permits increased shelf-life
2. Facilitates storage and transport
3. Reduces bulkiness and losses due to perishability
4. Concentrates the nutritive value due to removal of water
5. Provides diverse utilisation e.g. baked (bread, cakes) and, fried (doughnuts, chapatti)...

Factors affecting quality of sweetpotato chips

The quality of sweetpotato chips is influenced by many pre- and post-harvest factors namely;

a) Cultivar (genetic) factor: inherent characteristics such as level of dry matter and sweetness.

b) Environmental factors: include light intensity, length of illumination, wind, dust. Wind may blow other foreign material that contaminate the chips before drying. During rainy conditions or prolonged intermittent sunlight interruptions due to cloud covers results in blackened chips.

c) Stage of harvesting the roots: Physiologically mature roots dry faster and produce pronounced colour of dry chips. Over mature roots tend to be desaccharified and produce darker chips. Premature roots into prolonged time of drying and less distinctive colour of the chips.

d) Culture methods:

a. Failure to wash off the soil, trim off and discard root hairs, might result in tainted dried chips.
b. Crushing roots using stones and drying chips on the ground or rocks results in easy contamination by soil material
c. Thicker slices lead to prolonged duration of drying, uneven drying and easy infestation by storage weevils.
d. Unventilated, leaking roofs, without pallets and overstocked stores lead to degradation and contamination of stored chips due to fungal growth, rotting and tainting by faeces and urine or rodents and insects.
e. The quality and colour of packing material affects the nutrient content of chips, especially loss of vitamin A content from orange fleshed sweetpotato chips.
f. Lack of sorting and grading of chips leads to and early infestation by weevils especially if the skin planks are not separated from small sized slices even if mechanically chipped, also affects the appearance, purity and odour of the chips,
g. Duration between harvesting roots and chipping: If roots are not processed within 48 hours after harvesting the chips will dry to black reddish colour due to oxidation.
h. Method of drying: Prolonged open drying reduces the level of vitamin A in the pro-vitamin A orange fleshed sweetpotato chips.
i. Level of expertise affects the rate of work performance and quality of chips because any delays processing may lead to deterioration.