Report of the 8th Sweetpotato Support Platform Meeting For East and Central Africa: Sweetpotato Post-Harvest Management and Agro-processing Chez Lando, Kigali, Rwanda, January 29-30, 2014

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2014

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A Background

The Sweetpotato Action for Security and Health in Africa (SASHA) project is a five-year Bill and Melinda Gates funded groundwork intervention for the wider 10 year vision under the Sweetpotato for Profit and Heath Initiative (SPHI). Under SASHA, three sub-regional support platforms (SRSPs), based in three countries with strong national sweetpotato research and development programs, were established to provide the organizational and management structure for developing long-term breeding skills and capacity in and for Africa. These are: a) Ghana for Western Africa sub-region; b) Mozambique for Southern Africa sub-region; and c) Uganda for Eastern and Central Africa sub-region. Each platform holds two stakeholder meetings each year to exchange ideas and to update the stakeholders on the progress of project activities. The meetings also serve as an avenue to conduct relevant trainings on specific areas such as gender, communications, seed systems and breeding, and therefore have a capacity building function to the stakeholders. Various stakeholders were consulted on the agenda of the 8th Sweetpotato Support Platform Meeting, and experts were consulted on the topics for presentation on Sweetpotato Post-Harvest Management and Agro-processing (SPPHMAP). SPPHMAP was among the main themes during the Challenge Workshop held in July 2008 in Addis Ababa, Ethiopia. During the 2008 workshop several constraints were identified and proposed as priority areas to be addressed through SASHA and the SPHI.

The two day meeting held in Kigali, Rwanda, January 29 – 30, 2013, focused on sweetpotato post-harvest management and agro-processing, and it enabled the experts to share their experiences and work on a way forward in the region.

Registration and Introductions

The meeting started at 8:00 with registration and self-introductions. A total of 33 participants (6 female, 27 male) from seven countries [Ghana (3), Kenya (6), Malawi (1), Mozambique (1), Rwanda (15), Uganda (6), and USA (1)]. Mr. Jan Ndirigwe welcomed all the participants and wished them fruitful deliberations, then introduced Dr. Jan Low, the Sweetpotato for Profit and Health Initiative (SPHI) Leader. The content of the presentations and discussions are presented in this report, and can also be accessed from the sweetpotato knowledge portal: http://www.sweetpotatoknowledge.org/.

B PRESENTATIONS

1. Jan Low. 2014. The Challenge and Opportunities for Sweetpotato Post-Harvest Utilization in SSA

Dr. Jan Low mentioned that the meeting held in Ethiopia in 2008 identified the challenges in the sweetpotato food value chain. The challenge of 2008 was: How to improve the value chain for sweetpotato given its bulky nature, undiversified use, and image as a poor person's food?

Attributes & Deficiencies of Sweetpotato		
Attributes:		**Deficiencies**
•High yields (usable mass per unit area per unit time) •Nutritional •Vitamin C •Vitamin A (orange-fleshed) •Soluble & Insoluble fiber •Polyphenols •Low glycemic index •Wide production geography •Relatively high stress tolerance (temperature and water) •Low fertility & land quality req. •Length of production cycle		•Production costs •Bulky – high transport cost •Storage requirements/perishability •Limited diversified use •Flavor •Heartburn/flatulence •Asexually propagated •Yield stability across different zones
Yield security (produces something)		

Structural Determinants of Sweetpotato Markets in SSA

- Localized production in dispersed production zones
- Seasonal supply of a bulky and perishable product
- High transaction costs and marketing margins
- Thin markets and marked price variability
- Low urban consumption as fresh roots

Leads to 2 Driving Hypotheses:

- Structural change in sweetpotato markets will require interventions across the value chain (see illustration, next page)
- Farmer investment in improved management techniques or improved root quality will require access to robust markets

Challenge of Consistent Sweetpotato Supply

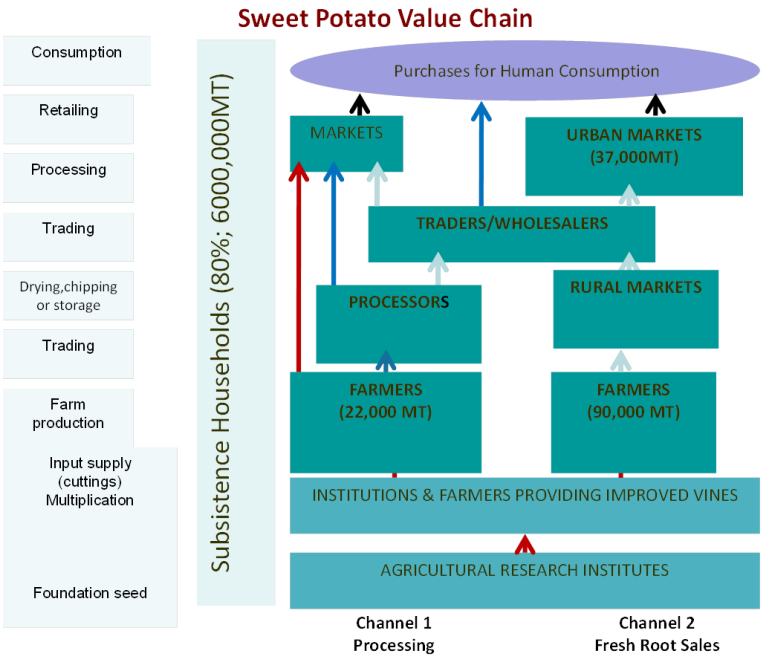
FRESH ROOTS:

- Poor handling during harvesting
- Poor handling during transport (extended bags)
- Few practice fresh root storage
  - Need for immediate cash
  - Lack of knowledge
  - Inappropriate methods (too costly structures)
  - Increases sugar content & there is moisture loss
- Few practice curing (toughens skin & heals wounds)
  - In ground curing (removing canopy XX days before harvest)
  - Out of ground curing (29ºC 90-95% Rel humidity for 4-7 days)

DRIED CHIPS

- Exists in some zones with prolonged dry season
- For OFSP –must avoid initial over-drying & there is

high beta-carotene degradation after storing > 2 months



The Opportunities for Nutritional, Impact Increasingly Recognized

- Orange-fleshed varieties can contribute to reducing vitamin A deficiency
  - van Jaarsveld et al., AJCN 81, 1080-87, 2005.
  - Low, JW et al., J. of Nutr. 137: 1320-1327, 2007
  - Hotz, C. et al., Brit. J. of Nutr. 1-14, 2011
- It does not take much to make a difference:

  100-125 gm for a young child
- Increasing interest in purple-fleshed varieties
  - Anthocyanins contribute the color (food colorant)

  --anti-oxidant, anti-carcinogenic, anti-diabetes
- All good sources of vitamins C & E, potassium, dietary fiber, polyphenols
- Relatively low glycemic index compared to staples
- Leaves rich source of lutein; good protein content compared to other leaves

The Opportunities for Diversified Use are Immense

Human Food	***Industrial***	***Livestock Feed***
Fresh	Starch	Swine (Pigs)
Canned	Flour	Cattle
Puree (Boiled & Mashed)	Alcohol	Goats

Baby Food	B-amylase	Chickens
Juice	Food coloring	Guinea Pigs
Crisps (thinly sliced/fried)	Citric Acid	Other
Chips (fries/thickly sliced)	Fructose	
Noodles	Glucose	
Bread	Maltose	
Biscuits	Monosodium Glutamate	
Donuts	Biofuel	
Cakes and other bakery products		
Snack foods (extruded)		

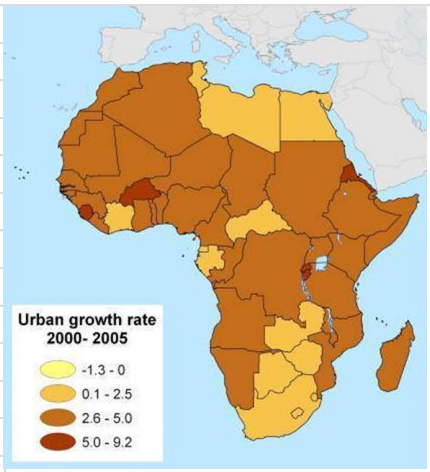
Asia, particularly China, lead with a diversity of products

Form	Total amount/Price (RMB Yuan)	Added value (compared with fresh root)
Fresh root	1 ton/400 RMB	
Coarse starch	160Kg/400RMB	0%
Refined starch	152Kg/456 RMB	14%
Instant noodle	137Kg/2055 RMB	414%

Ways sweetpotato is used in China:
58% feed, 10% processing, 12% fresh, 8% seed, 12% waste

Why Should We Care About Sweetpotato Product Development?

1) SSA has the fastest growing urbanization rates in the world
2) Rural farmers need markets, and sweetpotato can be widely grown by all classes
3) Due to their bulkiness, fresh sweetpotato becomes expensive in urban centers distant from production areas
4) Urban consumers want convenient foods that are less time-consuming to prepare
5) Wheat and rice, staples popular with urban consumers, often are imported commodities
6) Sweetpotato is often considered a crop of the poor– it has an image problem
7) Diabetes is on the rise among better off urban consumers and VAD is a problem among the poor



What Products Make Sense for Africa?		**Key question to address:**
Very different conditions and		Use of puree vs flour
preferences in China vs SSA		1.25 kg fresh root makes 1 kg puree
1) Average yields in China: 17 t/ha		vs 4-5 kg fresh root give 1 kg flour
2) Average yields in SSA: 6 t/ha		
--- Less surplus to sell		**Suggested Starting Point**
--- Food security 1st priority		Get an understanding of your markets
--- Strong fresh root market		What products are out there?
--- High cost/kg for processing		What do they cost?
compared to alternatives		Who is buying them?
(e.g. cassava)		What are the estimated quantities being sold?
Therefore:		
1) Does the product make economic sense?		Is it a candidate for consideration?
2) Who is our target market?		Can sweetpotato replace a significant
Should we focus on healthy products?		percentage of the key ingredients?
		What would it cost to make the product
		with and without sweetpotato?

Must Pay Attention to Relative Prices

- Must understand the prices of the alternative ingredients and how they fluctuate during the year
- Must develop test products and get feedback from relative consumer target Groups

Products in Mozambique	Major ingredients	Units per batch (MT)	Unit selling price (MT)	Revenue (MT)	Total cost (MT)	Net return to labor (MT)	Net return per unit sold	
							MT	US$
Bread buns	Wheat flour, yeast, improver	2,880	1,000	2,880,000	2,414,000	466,000	162	0.007
Twisted Berlin bun	Wheat flour, sugar, yeast	270	1,000	270,000	249,817	20,183	75	0.003
Coconut sugar bar	Coconut, sugar	600	500	300,000	245,000	55,000	92	0.004
Biscuit	Wheat flour, sugar, yeast	150	1,000	150,000	138,700	10,300	69	0.003
Fried doughnut	Wheat flour, sugar, oil	70	500–1,000	58,310	22,350	25,060	258	0.015

Sensitivity analysis examining ratio of prices of wheat flour and orange-fleshed sweet potato root and its effect on net return to labor of golden bread buns compared with pure wheat flour buns[a]

Relative price		Total cost of wheat flour (MT)	Net return to labor per batch			% increase in net return per golden bread bun	Net return to labor per golden bread bun (US$)
Kg wheat flour/kg raw sweet potato root	Kg wheat flour/kg cooked sweet potato root		Wheat flour bun (MT)	Golden bread bun (MT)	Golden bread bun (US$)		
1.5	1.25	4,575	142,906	152,468	6.35	6.7	0.024
1.8	1.50	5,490	128,776	143,990	6.00	11.8	0.023
2.1	1.75	6,405	113,076	134,570	5.61	19.0	0.021
2.4	2.00	7,320	98,946	126,092	5.25	27.4	0.020
3.1	*2.50*	*9,150*	*70,686*	*109,136*	*4.55*	*54.4*	*0.017*
3.4	*2.75*	*10,065*	*56,556*	*100,658*	*4.19*	*78.0*	*0.016*
3.5	*2.84*	*10,402*	*50,276*	*96,890*	*4.04*	*92.7*	*0.015*
3.5	2.90	10,614	47,136	95,006	3.96	101.6	0.015
3.7	3.00	10,980	40,856	91,238	3.80	123.3	0.014
4.0	3.25	11,895	26,726	82,760	3.45	209.7	0.013
4.3	3.50	12,810	12,596	74,282	3.10	489.7	0.012

For OFSP Products, Must Determine How Much Beta-carotene is in the Final Product

- Need to have nutrient analysis done. It is the *trans*-beta-carotene (BC) that is fully converted into vitamin A. Most BC in sweetpotato is *trans,* not *cis* but processing can affect the ratio.
- Varieties differ… Use medium to dark intensity OFSP for products
- Be careful about claims..

Variety[a]	β-Carotene content[b]		β-Carotene and vitamin A content[b]	
	Total β-carotene (µg/g bun)	Trans-β-carotene (µg/g bun)	Trans-β-carotene (µg/60 g bun)	**Vitamin A (µg RAE/60 g bun)[c]**
Medium intensity				
Resisto (fresh)	19	15	890	**74**
Persistente (fresh)	20	15	879	**73**
Gabagaba (fresh)	21	16	969	**81**
Lighter intensity				
TIB4 (fresh)	13	9	549	**46**
LO-323 (fresh)	12	9	540	**45**

Be Careful About What You Can Claim

- The potential contribution of any product to improved nutrient intakes depends on the age and sex of those consuming it
- The US Food and Drug administration guidelines: per reference amount
  --a good source of vitamin A if it contains 10% to 19% of the daily value
  --an excellent source if it contains 20% or more of the daily value

Variable	60-g bun	110-g bun
Total β-carotene (µg)	1,132	2,078
Trans-β-carotene (µg)	890	1,631
Vitamin A value (µg RAE[a])	74	136
% contribution to vitamin A dietary reference intake[b]		
Children 1–3 yr	25	45
Children 4–8 yr	19	34
Children 9–13 yr	12	23
Non-pregnant women ≥14 yr	11	20
Pregnant women	10	18
Lactating women	6	10
Men ≥14 yr	8	15

12 µg of *trans*-β-carotene = 1 µg of retinol = 1 µg of retinol activity equivalents (RAE)

Way Forward

- Products have potential… focus on public-private sector partnerships
  to develop economically viable products with significant markets
  -- private sector has marketing expertise and funds for advertisement
- Educate the consumer; willingness to pay increases when knows nutritional benefits
- Invest in improved fresh root storage and financial services to support that
- Improve storage of puree without refrigeration
- Improve nutrient composition analysis and shelf life studies

2. Prof. Jean Jacques Mbonigaba Muhinda. 2014. Welcome remarks to Participants of the 8th Sweetpotato Support Platform Meeting for East and Central Africa

It is our pleasure and honor for Rwanda and particularly RAB to have this important Sweetpotato Support Platform Meeting (SPP) focused on post-harvest utilization in Rwanda. As the representative for East and Central Africa for the Sweetpotato for Profit and Health Initiative, I am pleased to note that this is the first time this bi-annual meeting is being held in Rwanda.

I am very delighted to welcome you in Rwanda, particularly Dr. Jan Low (SPHI coordinator for Sweetpotato for Profit and Health Initiative/SPHI), other CIP scientists, and scientists, private

sector processors, and other practitioners from Uganda, Kenya, Ghana, Malawi, Mozambique, and of course Rwanda.

Under the auspices of the Sweetpotato Action for Security and Health in Africa Project, better known as the SASHA project, for the last four years Sweetpotato Support Platform meetings have been held twice a year in each of the 3 major sub-regions: East and Central Africa, Southern Africa, and West Africa. The primary purpose of these meetings is to build a community of practice that is actively exchanging information. It also provides an opportunity to provide a forum for short-term trainings. In past meetings, trainings have included how to communicate scientific findings effectively, gender analysis, and use of the Sweetpotato Knowledge Portal.

The 8th Sweetpotato Support Platform (SSP) Meeting for East and Central Africa will focus on sweetpotato post-harvest utilization, with emphasis on agro-processing. Because of this technical focus, interested participants from other sub-regions have been invited.

Rwanda has been chosen for this meeting because the Rwanda Agriculture Board is committed to improving the nutrition and economic well-being and has recognized the potential of orange-fleshed sweetpotato to contribute to improving food security, nutrition, and market opportunities for smallholder farmers.

Among SSA countries, Rwanda has some of the high consumption of sweetpotato per capita in Africa, over 80 kg per capita per year. Sweetpotato is part of us --when a Rwandese farm does not have sweetpotato that means hunger for the household. In fact, at times it is referred to a local defense. But our farmers often complain of lack of markets for their sweetpotato and at times, gluts cause prices to collapse.

Over the past 4 years, RAB has been working together with the CIP, Catholic Relief Services, YWCA, Imbaraga, the Kigali Institute of Science and Technology and the private sector company Urwibutso (SINA) Enterprises, we have developed value chains that link farmers to the agro-processing company and also assist farmer organizations to commercialize sweetpotato mandazi or donuts. We need sound financial services, understand consumer preferences, and understand market dynamics, so what Dr. Jan Low has presented is important, if we have to shift the role of sweetpotato from a crop of the poor to a commercially viable crop. We are also pleased that 75% of the farmers who have been linked are women, who in our tradition have been at the forefront of sweetpotato production and utilization.

Food scientists from RAB, students from the Kigali Institute of Science and Technology, CIP, and Innovative Ingredient Solutions have worked to develop economically viable processed products using sweetpotato puree, which is boiled and mashed sweetpotato. These products include bread, donuts, queen cakes, and most important the Akarabo Golden Power Biscuit. The Akarabo Golden Power Biscuit is now in most urban and peri-urban areas of all districts and people like it. This is really great. There are a lot of testimonies and success stories by famers through the media.

It has shown that we can use sweetpotato in different products and improve its visibility. It helps us change its image as just a food security crop and helps its image as a cash crop as well.

Yesterday I met with a group of experts from the Netherlands and German who told us that the greatest need of our imported cows is vitamin A, so the potential for OFSP in the dairy industry is big. We have two big plants in Rwanda which need about 200 metric tons per day; these are almost as big as the ones found in Brazil, Russia and the Ukraine. However, to use sweetpotato in these plants, we need to come up with a strong business plan to have competitive prices for sweetpotato and its products such as sweetpotato flour.

I want to thank all members of the team for their achievements so far. I particularly want to recognize Mr. Sina Gerard for his willingness to take the risk to develop a new product and his commitment to improving the lives of farmers in Rwanda. The President said, "We need more Sinas".

On the 2nd day of the meeting, this group will be able to visit farmers and the agro-processor involved in this value chain work. Today, we hope that experiences will be shared from around the region, so that work on sweetpotato product development can develop faster. I also understand that the group will be discussing whether to form a Technical Working Group to Tackle Post-Harvest and Processing Issues concerning Sweetpotato. All this is still in the context of the committed goal of the Sweetpotato for Profit and Health Initiative to unleash the full potential of sweetpotato to improve the livelihoods of farmers and consumers in SSA.

Another major part of the sweetpotato value chain story is the investment RAB is making with SASHA and AGRA support in breeding better adapted sweetpotato varieties and the production of disease free foundation planting material in our tissue culture lab and screen houses at our station at Rubona. This has been critical for raising yields on smallholder plots, which has enabled farmers to have a surplus to sell. Unfortunately, you will not have time to visit Rubona during this meeting, but improving productivity is essential for successful market development.

I also want to take this opportunity to let you know that the Government of Rwanda is very committed to improving the nutrition of its people and sees biofortification as a major contribution that agriculture can make to this cause. In addition to orange-fleshed sweetpotato, HarvestPlus and RAB are collaborating in the development and dissemination of iron-rich beans. I am pleased to announce that
Rwanda will be hosting the Global Biofortification Conference in Kigali from 30 March through 2nd April 2014. I will be the chair for the local organizing committee. We expect over 400 participants in this conference. Clearly OFSP will be one of the major crops on this agenda.

In closing, I wish all of you a pleasant stay in Rwanda and wish you successful deliberations during this meeting. I officially declare this meeting open.

3. **Kirimi Sindi and Jean Ndirigwe. 2014. Sweetpotato product development in Rwanda: Lessons Learned to Date**

Objectives

1) To develop, compare, and evaluate the relative efficiency of two sweetpotato product value chains and their potential to increase farmer income with gender equity

2) To re-position white and orange fleshed sweetpotato (OFSP) and its products in the rural, urban and semi-urban consumer markets.

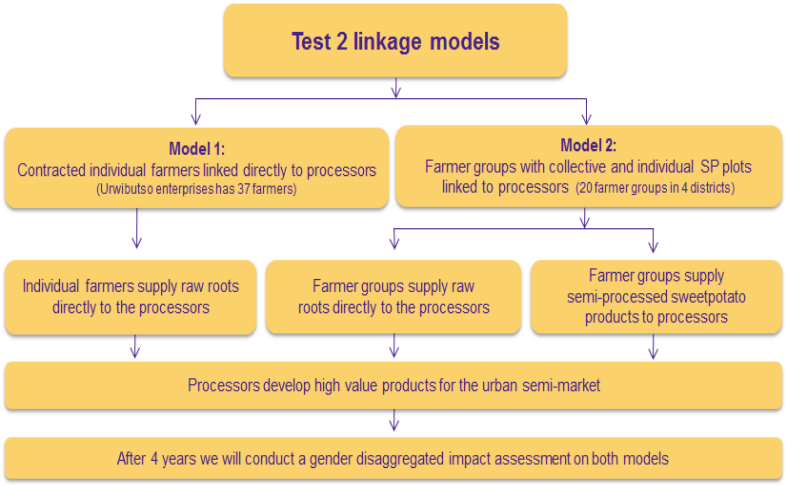
Hypotheses:

a) Private-sector led development of processed SP products results in increased farmer incomes (test 2 Models)

b) b) Partial/full processing of roots by farmers results in greater participation and revenues for women and youth farmers (compared to factory-based processing)

c) c) Effective marketing can establish SP as a high value crop in urban markets.

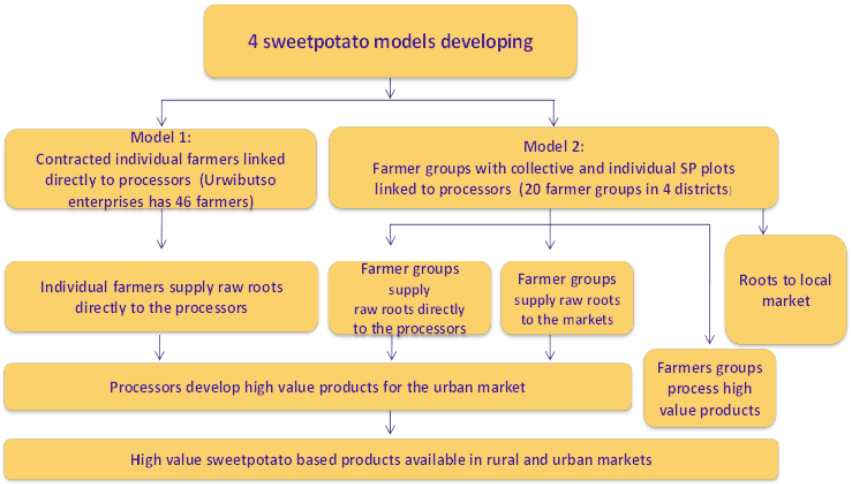
Comparison of value chain models



Model Developing

Raw material supply chain

- Build a reliable supply of sweetpotato roots through the year
- Quality planting material of the right varieties for different locations
- Growing calendar that is normally under the mercy of rain fed agriculture
- Roots quality
- Time of harvesting (Too early or too late)
- Grading before delivery



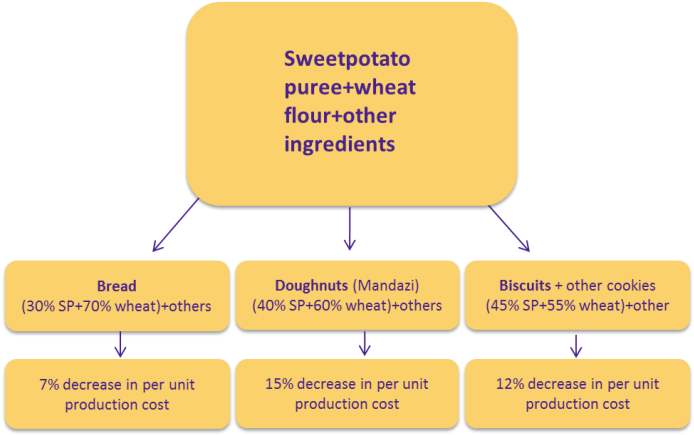
Raw material supply chain continued

- Trainings and education
- Farmers self-processing in training and commercially, assist in understanding roots quality concerns

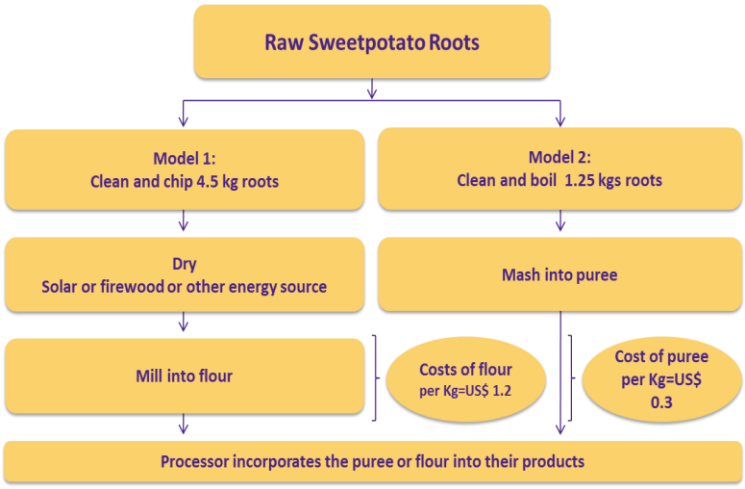
Processor/private sector collaboration

- Several considerations
- Experienced Vs New (creation)
- Large Vs Small
- All these have consideration in the level of investment
- Machinery, technical backing, supply chain development, marketing support

Does it make economic sense to incorporate sweetpotato puree into bakery products?



Processing Technology Development



Product development:

1) Baked products (E.g. bread, biscuits, cakes, doughnuts)
2) Juice

Baked products

- Choice of the form of sweetpotato utilization is important early
- Equipment choices
- Initial research is key to getting a winner
- Good technical backing
- Consumer sensory testing

Sweetpotato juice

- This has been more challenging than baked products
- Development of juice is not just about tweaking of ingredients but full innovation
- This has revolutionized our thinking about products production process

  Juice innovation: There is a range of products from juice innovation

Product presentation

Product presentation gives a message
Generally we buy
Dreams
Aspirations
Image
Attributes (healthy alternative vit A)

Biscuits Nutrient Analysis (per 100 grams)

Parameter	Wheat :SP (60:40)
Moisture (%)	6.4 ± 0.2
Ash (%)	1.4 ± 0
Fat (%)	15.0 ± 0.2
Carbohydrates (%)	68.1
Crude fiber (%)	0.4 ± 0.2
Protein (%)	8.6 ± 0.1
B-Carotene mg/100g	5.4 ± 0.4
Energy (KJ)	1,858.90

Beta-carotene converts into Retinol Activity Equivalents (RAE) in OFSP: 12 units BC: 1 unit RAE
5.4 mg/100 gms = 450 RAE

4 biscuits	43 gms	
RAE (micrograms)	193 ugs	
	Required RAE Daily	% of Daily Req.
Child under 9 years old	400	48%
Non-pregnant woman	700	28%
Adult men	900	21%

USA standards: a product must meet 20% of daily needs to be marketed as an excellent source of Vitamin A

Product packaging

- Name choice- Akarabo Golden Power Biscuit
- Packaging design – Pull all the tops
- Packaging materials
- Market segmentation in product presentation to the customers

Akarabo Golden Power Biscuits was officially launched in Rwanda in 2013. There have been OFSP promotional activities (e.g. Mandazi day, printing of OFSP T-shirts, processing OFSB based products at Nyirangarama).

4. **Francis Kweku Amagloh. 2014. Developing Sweetpotato-based Weaning (Complementary) Food: Technical and Cost Consideration**

- Foods and liquids other than breast milk given to infants and young children when breast milk alone is not sufficient to meet their nutrient demands for growth.
- Exclusive breastfeeding (first 6 mo)
- The attainment of one's full potential in life is largely influenced by adequate nutrition during infancy
- Hence the need to feed infants with nutritionally adequate complementary food
- Background, the gloomy picture, countries are categorized by WHO by degree of public health importance if vitamin A deficiency (VAD), April 1995

(http://www.who.int/vmnis/vitamina/prevalence/mn_vitamina_map_1995.pdf)

- A total of 34 countries account for 90% of the global burden of malnutrition

Bhutta Z A et al. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? The Lancet, 2013, Electronic version.

- Vitamin A deficiency among children <5 years in sub-Saharan Africa remains high (44%), second to South-East Asia (50%), compared with the worldwide occurrence of 33% [World Health Organization, 2009]

- The reason could be the widely used cereal-based complementary foods in low-income countries, which are naturally low in β-carotene

- "However, evidence on the nutritional effect of agricultural programmes is inconclusive—except for vitamin A from biofortification of orange sweetpotatoes—largely because of poor quality evaluations."

Ruel M T et al. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? The Lancet, 2013, Epub ahead of print.

Guidelines for complementary foods

References:

a) www.codexalimentarius.org/input/download/standards/290/cxs_074e.pdf

b) Codex Alimentarius Commission. (1991). Guidelines for formulated supplementary foods for older infants and young children (No. CAC/GL 8). Rome, Italy: Codex Alimentarius Commission. Retrieved from http://www.codexalimentarius.net/download/standards/298/CXG_008e.pdf

- Starch is efficiently digested by infants when it is present in complementary food in small quantities

- Nestlé uses cereals that are hydrolysed enzymatically (CHE on package) in the production of dry infant cereals to hydrolyse starch to maltose and maltodextrin

Lentze MJ. Gastrointestinal development, nutrient digestion and absorption. In: Koletzko B, editor. Pediatric nutrition in practice. Basel: Karger; 2008. p. 76-9.

Weaver LT. Complex carbohydrates and sugars. Pediatrics. 2000; 106(Suppl. 5): 1291.

Nestlé. Baby nutrition: Product-Dry infant cereals. Nestlé; 2006 [cited 2011 October 10]; Available from: http://www.nestlebaby.com/au/baby_nutrition/products/Infant_cereals/LittleTummies.htm

The ComFa Formulations

Ingredient (g/100 g) *	Household-level	Industrial-level
Sweetpotato	66	72
Full fat soyabean flour	10	15
Soyabean oil	6	6
Iodised salt	0.5	0.5
Sugar	0.5	0.5
Skim milk powder	-	6
Fish powder(anchovies)	17	-

*Nutrient composition of the ingredients was available in the GAIN Nutrition Calculator except for sweetpotato and fishmeal. Nutrient composition of sweetpotato FoodWorks version 6 (FoodWorks, 2009). Data on fish (Engraulis hepsetus) to be used was not available; therefore the data on Engraulis encrasicholus from USDA (http://www.nal.usda.gov/fnic/foodcomp/search/) was used.

Sweetpotato-based CF from flour

i) Industrial-based (SP, soybean flour, oil, skimmed milk powder and sugar):

a) Roller-dried ComFa b) Extrusion-cooked ComFa

ii) Homestead (SP, anchovy powder, soybean flour, oil and sugar): Oven-toasted ComFa

Sweetpotato-based CF from roots:

http://www.radionz.co.nz/national/programmes/ourchangingworld/audio/2533859/weaning-food-for-african-children

Compositional data: ComFa vs. Weanimix

- Both the sweetpotato- and maize-based CFs met the energy (1670 kJ/100 g) and fat (10-25 g/100 g) stipulated levels in the Codex Standard
- Porridge prepared from the ComFa formulation is less viscous, thus, reduction of excessive dilution with water, a practice that invariably leads to “energy and nutrient thinning”, that is, the reduction of energy and nutrient densities

Amagloh F K et al. Sweet potato-based complementary food for infants in low-income countries. Food Nutr. Bull., 2012, 33: 3-10

Energy and macronutrient densities and levels of other carbohydrate fractions of sweet potato-based and cereal-based CFs

	Energy	Protein	Simple sugars	Fructose	Fat	Soluble dietary fiber	Insoluble dietary fiber	Maltose	Lactose	Starch
Complementary food	**(kcal/g)**	g/100 kcal				g/100 g				
OFSP CF	0.89^{x}	$4.53 \pm 0.06^{w,x}$	4.39 ± 0.10^{w}	1.45 ± 0.04^{w}	2.36 ± 0.04^{w}	2.83 ± 0.45^{w}	9.45 ± 1.49^{w}	20.38 ± 0.41^{x}	ND	13.19 ± 0.20^{z}
CFSP CF	0.87^{y}	4.33 ± 0.10^{x}	3.02 ± 0.04^{x}	0.64 ± 0.01^{x}	2.35 ± 0.02^{w}	1.99 ± 0.35^{w}	$8.06 \pm 0.53^{w,x}$	24.10 ± 0.54^{w}	ND	17.11 ± 0.22^{y}
Weanimix	0.88^{y}	4.73 ± 0.20^{w}	0.52 ± 0.00^{z}	ND	1.94 ± 0.01^{y}	0.03 ± 0.06^{x}	6.90 ± 0.64^{x}	2.72 ± 0.12^{z}	ND	48.38 ± 0.50^{w}
Cerelac	1.19^{w}	3.25 ± 0.04^{y}	1.69 ± 0.02^{y}	ND	2.23 ± 0.02^{x}	0.45 ± 0.31^{x}	1.03 ± 0.20^{y}	10.31 ± 0.12^{y}	14.67 ± 0.22	30.93 ± 0.34^{x}
Codex specification	≥0.8	2.0 – 5.5	≤5.0	≤2.5	≤4.5	—	—	—	—	—

OFSP and CFSP CF were processed directly from the roots

Amagloh and Coad. Orange-fleshed sweet potato-based infant food is a better source of dietary vitamin A than a maize–legume blend as complementary food. Food Nutr. Bull., 2014, "In Press"

Micronutrient density and levels of ascorbic acid and phytate in sweet potato-based and cereal-based CFs

Complementary food	Sodium (mg/100 kcal)	Calcium (mg/100 kcal)	Vitamin A (µg RAE/100 kcal)	Ascorbic acid (mg/100 g)[c]	Phytate (mg/100 g)	Total polyphenols (mg gallic acid equivalents/100 g)
OFSP CF	$54.50 \pm 0.41^{x,y}$	$128.30 \pm 12.95^{w,x}$	226.24 ± 30.70^{w}	32.48 ± 0.48^{x}	229.85 ± 20.36^{x}	466.27 ± 9.36^{w}
CFSP CF	59.05 ± 1.27^{x}	135.08 ± 14.23^{w}	$21.79 \pm 0.35^{x,y}$	$37.40 \pm 0.61^{w,x}$	78.62 ± 3.50^{y}	466.42 ± 34.97^{w}
Weanimix	36.19 ± 0.66^{y}	100.90 ± 12.84^{x}	0.58 ± 0.20^{y}	ND	438.10 ± 8.58^{w}	263.68 ± 17.82^{x}
Cerelac	94.16 ± 17.23^{w}	$107.64 \pm 1.68^{w,x}$	47.72 ± 5.84^{x}	53.11 ± 12.07^{w}	66.92 ± 4.00^{y}	213.45 ± 29.93^{x}
Codex specification	≤ 100	≥ 80	60 – 180	≤ 50	—	—

OFSP and CFSP CF were processed directly from the roots

Amagloh and Coad. Orange-fleshed sweet potato-based infant food is a better source of dietary vitamin A than a maize–legume blend as complementary food. Food Nutr. Bull., 2014, "In Press"

Cost estimation based on ingredients

Complementary food and ingredient	Moisture (/100 g)	Amount (kg)	Cost (Gh¢)[b]	Preparation method
OFSP complementary food				
Beauregard (OFSP)	80.38	6.63	6.63	Peeling and dicing
Full-fat soybean flour	7.6	0.17	0.29	Roasting, dehulling, and milling
Soybean oil	—	0.14	0.96	—
Anchovy powder	10.06	0.44	5.5	Breaking off heads and milling
Total cost (Gh¢)			13.38	
CFSP complementary food				
"Toka Toka gold" (CFSP)	74.22	5.04	5.04	Peeling and dicing
Full-fat soybean flour	7.6	0.17	0.29	Roasting, dehulling, and milling
Soybean oil	—	0.14	0.96	—
Anchovy powder	10.06	0.44	5.5	Breaking off heads and milling
Total cost (Gh¢)			11.79	
Weanimix				
Refined maize flour	14.2	1.75	1.75	Dehulling, milling, and roasting
Full-fat soybean flour	7.6	0.32	0.55	Roasting, dehulling, and milling
Groundnut paste	1.2	0.2	1.05	Roasting, dehulling, and milling
Anchovy powder	10.06	0.44	5.5	Breaking off heads and milling
Total cost (Gh¢)			8.85	

Gh¢1.00 = US$0.52 (January 2013).

$$Amount\ of\ ingredient\ to\ weigh,\ adjusting\ for\ moisture = \frac{\text{Quantity of the food to be produced} \times \text{proportion of ingredient in the formulation}}{100 - \text{moisture content of ingredient}}$$

Nutritional Concerns of sweetpotato-based CF

- High polyphenols
- May limit iron absorption, and thus being low phytate may not be of an advantage
- High fibre
    - Negative or Positive?
- Answers in conducting randomized control trials

Sandpit method of storing sweetpotato roots, Ghana

Discussion

Question (Q): Jan. What was cost of SP ComFa compared to cereal based food?
Answer (A): Slightly higher than cereal-based CF based on the proportion of the ingredients used. We have not considered the cost of adding vitamin A to get to the level in the ComFa products. We estimated the cost of sweetpotato on 1 Ghana Cedis/Kg.Talked about the nutritional value. Francis is slightly concerned about polyphenols that may inhibit iron absorption. Comment from audience member: Polyphenols tend to be more concentrated in the skin than the flesh, so might not be much of a concern. Francis suggested we need to investigate this in a feeding trial.

5. Gaston A. Tumuhimbise. 2014. Determination of beta-carotene bioaccessibility in orange fleshed sweetpotatoes

Dr. Tumuhimbise based his presentation on the paper which was published as part of his PhD research: Tumuhimbise. G.A., Namutebi, A.S., and Muyonga, J.H. 2009. Microstructure and in vitro b-carotene bioaccessibility of heat processed orange fleshed sweet potatoes: Plant Foods for Human Nutrition; 64: 312-318.

Most of what was in the presentation follows.

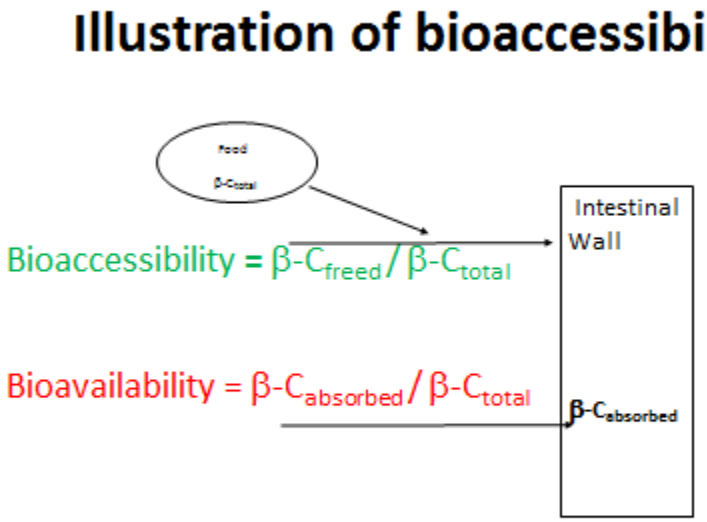
Background

- Growing interest in OFSP as a source of provitamin A carotenoids

  Levels of beta-carotene (BC) in OFSP are enough to alleviate vitamin A deficiency (VAD)

  OFSP have become central in the fight against VAD
- beta-carotene is affected by processing conditions e.g heat and light
- Heat treatment causes structural modification of BC
- Processing may enhance the release of carotenoids
- Need for information on processing conditions on bioaccessibility

- Bioaccessibility refers to the amount of an ingested nutrient that is available for absorption in the gut after the process of digestion (Hedren, Diaz, & Svernburg, 2002)
- Bioavailability refers to the amount of the nutrient that is absorbed and utilised in the body (Tanumihardjo, 2002)



Carotenoid bioaccessibility is influenced by several factors (matrix, presence of fat, heat treatment/processing, storage conditions, fiber co-ingested with carotenoid)

Objective of the study: To determine the influence of traditional processing methods on the OFSP microstructure and in vitro bioaccessibility of beta-carotene

Ejumula, SPK004/6/6, SPK004/6, SPK004 and SPK004/1 used in the study were obtained from Luweero; roots were harvested at 4.5 months.

Sample preparation:

Boiling: 250 g of slices were boiled for 20 min at 92^{o}C

Steaming: 250 g slices steamed in banana leaves for 30 min at 94^{o}C

Deep frying: 200 g were immersed in 300 ml of preheated oil for 10 min at 170^{o}C

Baking: 200 g of slices were baked for 15 min at 180^{o}C

Carotenoids extraction and analysis: 1) Carotenoids were extracted using acetone and separation of phases was done using PE (40-60oC) and analyzed using HPLC (Benggston et al., 2008), 2) Carotenoids

were calculated on dry matter basis, 3) Identification was done using aunthentic standards

Determination of in vitro bioaccessibility: 1) The bioaccessibility was determined using an in- vitro digestion model (Hedren et al, 2000), 2) This method simulates digestion in the gastro-intestinal tract, 3) Micellar fraction was separated by centrifugation followed by filtration

Microscopy: Tissues (6 x 3.4 x 3.4 mm) were processed and examined under a light microscope

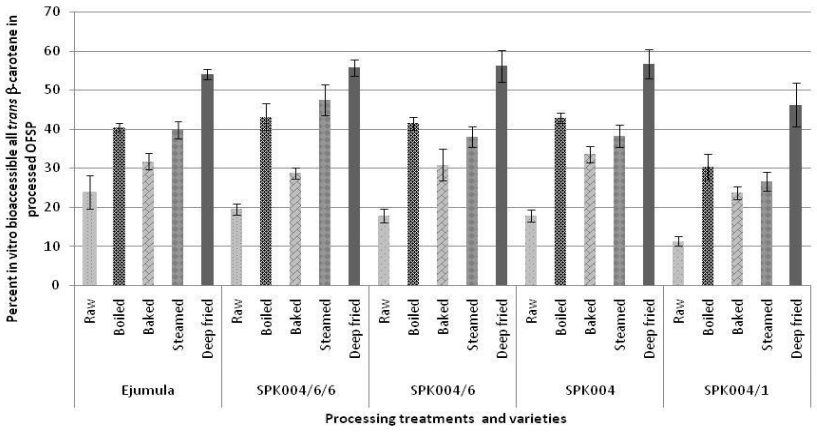
Results:

All-trans- β-carotene (µg/g dm) in raw and processed OFSP varieties

Variety	Raw	Boiled	Baked	Steamed	Deep fried
Ejumula	34.77± 10.17^{a}	106.53± 5.02^{a}	78.32± 8.14^{a}	105.79± 4.4^{a}	150.79± 9.67^{a}
SPK004/6/6	41.53± 3.51^{a}	70.74± 3.98^{b}	48.03± 5.22^{b}	64.64± 4.87^{b}	101.14± 9.67^{b}
SPK004/6	33.78± 4.38^{a}	69.25± 1.24^{b}	44.35± 2.64^{c}	49.43± 2.67^{c}	58.80± 3.94^{c}
SPK004	18.18± 2.07^{b}	37.18± 3.07^{c}	18.54± 2.51^{d}	25.34± 1.16^{d}	40.54± 3.73^{d}
SPK004/1	7.63± 1.08^{b}	18.36± 1.26^{c}	11.46± 1.33^{e}	13.48± 0.94^{e}	19.30± 1.05^{e}

The values are means ± standard deviation (n = 3). Means in the same column with different superscripts are significantly different at p ≤ 0.05

Effect of processing methods on the *in vitro* beta carotene bioaccessibility of OFSP.



Values (percent bioaccessibility) are given as mean ± SD (n= 3)

Conclusions

a) In vitro bioaccessibility varied thus; raw< baking< steaming/steaming < deep frying
b) Heat processing reduces beta-carotene content but increases bioaccessibility
c) Presence of fat in diet improves the bioaccessibility of beta carotene
d) Heat processing disrupts or softens plant cells

Discussion:

Q: Jan. What equipment did you use for measuring the bioaccessibility?
A: You are trying to mimic what takes place during digestion. The in vitro digestibility method is to mimic the gut, starting with the mouth. Finally, carotenoids are extracted from the so-called micelle fraction and then measured using HPLC.
Q: Francis. Have you validated your model using an in vivo system? For example, using gerbils.
A: Yes, the work has been done and the results showed similar levels of bioaccessibility.
Q: Godfrey. Did you find relationships between quality attributes, such as dry matter content, and the results with bioaccessibility? Consumers may reject this.
A: Not really. There is a lot of work going on to increase dry matter content. Also remember that the kids are the ones who need the provitamin A and they do not demand high dry matter content.
Q: Damien. Are there processing methods that can be used to keep beta-carotene high during processing?
A: Unprocessed and whole roots retain good carotenoid content. As soon as you cut up the sweetpotato, you expose it to air and may lead to greater degradation. Anyway, when you process, particularly if you use a little oil, you will boost accessibility even though you lose 20% through processing.

Comment: Jan Low. I always thought that the high heat of deep-frying would degrade the carotenoids, but it was very interesting to learn that the fried product is more bioaccessible.

6. <u>Antonio Magnaghi. 2014. Sweetpotato Purees and Concentrates</u>

On the title slide and last slides of Antonio's presentation, there were these words of wisdom: "If you look at what you do not have you have nothing, if you look at what you have, you have everything"

The main points in the presentations are outlined here.

Preparation of Puree

Factors to consider: 1. Hygiene, 2. Water quality, 3. Amount of water used, and 4. Cooking time

Processing involves: 1. Cleaning, 2. Boiling, 3. Peeling, 4. Mashing, and 5) Sieving

Preparation of concentrate involves: 1. Cleaning, 2. Peeling, 3. Mincing, 4. Straining, and 5. Pasteurization

Factors to consider: 1. Oxidation, 2. Grate (cake), 3. Pasteurization

Application of puree: Cookies, biscuits, cup cakes, muffins, pound cake, pie filling, functional ingredients (stabilizer, thickener).

Application for concentrate: Beverages, bread bakery, donut, fine baking, ice cream, dairy, and juice.

Preserving: Use preservative, vacuum packing

Preserving and acidifying agents: citric acid, ascorbic acid (vitamin C), sodium acid pyrophosphate (SAPP), sodium benzoate, potassium sorbate.

Preserving, Target blending

Blending of the puree or concentrate with sugar, hence, sugar becomes a preserving agent which is considered in the final formulation

For example, in cake or cookies, you will have to adjust the amount of sugar to be added by the percentage of the sugar in the puree or concentrate.

Discussion

Q: Francis. What happens to the cake when making bread?
A: You add the concentrate early on, and allow rising to take place, finally adding the cake.
Q: Godfrey. You spoke about what can be done at the farm level, but your presentation only showed fancy equipment.

A: You can get lower tech equipment, but you really do need to invest in an energy source. If people still understand the process, then there is no problem for people to implement. At the local level, the main challenge is hygiene. For example, we are coming up with a locally fabricated mincer to be able to produce concentrate. However, people need to understand the processes.
Q: Agnes. What happens to the grated leftover?
A: You put the grate in at the end.
Q: What variety was used?
A: Sindi. There are different varieties, and the process needs to be adjusted based on different varieties. This presents challenges in processing. Carceapedo is good for puree while the lower dry matter type (Gihingamukungu; 97-062) is best for juice.
Q: Francis. What can I do if I do not have proper equipment to extract concentrate.
A: If you get stones to crush or meat mincer, then you can do a fine job.
Comment by Kirimi: We tried to use very appropriate level technology at the farm, but when we went to the bakeries, they wanted pre-processed product that is produced hygienically at the farm level because they do not want to have to do the processing at the bakeries.

Remember: “If you look at what you do not have, you have nothing. If you look at what you have, you have everything.”

7. Agnes Namutebi. 2014. Selecting the right product for the right target group: Sweetpotato the raw material – what do we know

Introduction

- Approximate and nutritional composition of sweetpotato
- Endogenous amylases and browning enzymes
- Physico-chemical changes in sweetpotato
  - ✓ Desired and undesired browning
  - ✓ Desired textural changes – mashiness/ mealiness
- Sweet potato carbohydrate (sugars and starch) changes due to various postharvest processes and conditions
- Range of products – starch as the main ingredient for confectionary, beverages (fermented and non-fermented), cooked/ prepared staples, dessert

Selected physio-chemical characteristics of sweetpotato (Source: Nabubuya et al., 2012)

Variety	Flesh colour	Dry matter (%)	Starch content (%)	Peak viscosity (cP)	Total sugar content (%)	Reducing sugar content (%)
Esapat	yellow	39.2	73.9	1,043	8.25	1.1
NASPOT 1	cream	36.2	73.6	**2,504**	9.31	0.9
Ejumula	deep orange	35.9	68.4	1,648	11.89	1.54
Kakamega (SPK004)	pale orange	34.6	71.7	**2,327**	10.29	**2.3**
Soroti	yellow	34.5	72.9	904	10.96	1.42
New Kawogo	white	34.3	69.9	917	16.1	1.68
NASPOT 2	white	32.9	71.8	1,917	8.51	1.21
NASPOT 10 (SPK004/6/6)	orange	32.5	70.3	868	13.59	**3.49**
NASPOT 9 (SPK004/6)	orange	30.7	69.1	826	10.6	1.27
Dimbuka	pale yellow	30.2	72.8	**3,039**	6.52	0.73

Selected physio-chemical characteristics of sweetpotato (Source: Nabubuya et al., 2012)

Variety	Flesh colour	Dry matter (%)	Starch content (%)	Total amylase content (mg/ ml/ min)
Esapat	yellow	39.2	73.9	**0.256**
NASPOT 1	cream	36.2	73.6	0.328
Ejumula	deep orange	35.9	68.4	**0.57**
Kakamega (SPK004)	pale orange	34.6	71.7	**0.414**
Soroti	yellow	34.5	72.9	0.261
New Kawogo	white	34.3	69.9	0.392
NASPOT 2	white	32.9	71.8	0.416
NASPOT 10 (SPK004/6/6)	orange	32.5	70.3	**0.516**
NASPOT 9 (SPK004/6)	orange	30.7	69.1	**0.569**
Dimbuka	pale yellow	30.2	72.8	**0.28**

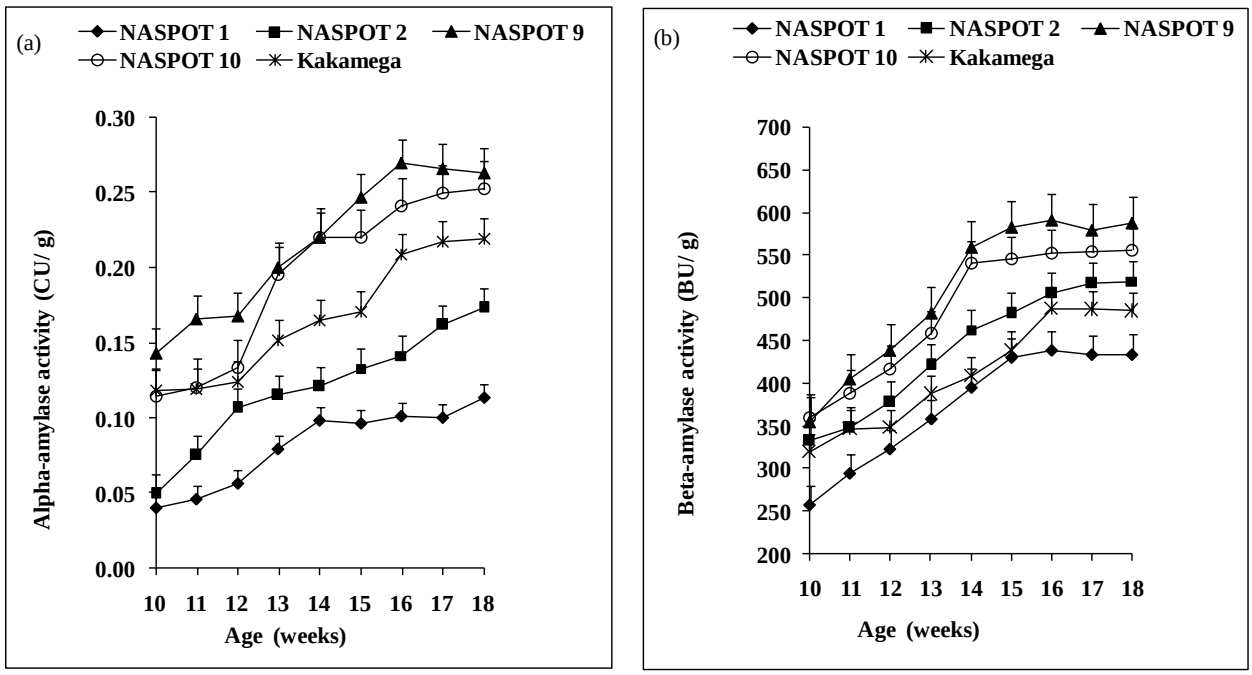


Fig 1. Changes in amylase activity of sweetpotato varieties during development: (a) α-amylase activity, Ceralpha Units per gram (CU/g); (b) β-amylase activity, Betamyl Units per gram (BU/g) (Source: Nabubuya et al., 2012)

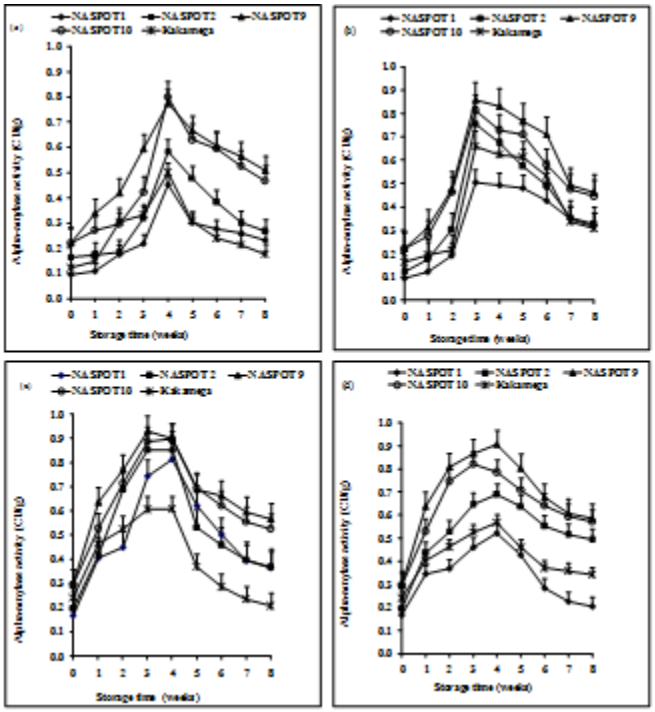


Fig 2. Changes in amylase activity of sweetpotato varieties subjected to various storage conditions:

(a) Freshly harvested roots stored under room conditions (23°C - 26°C & 70% - 80% relative humidity);

(b) Freshly harvested roots stored in a pit (19°C - 21°C & 90% - 95% relative humidity);

(c) Cured roots stored under room conditions (23°C - 26°C & 70% - 80% relative humidity);

(d) Cured roots stored in a pit (19°C - 21°C & 90% - 95% relative humidity)

(Source: Nabubuya et al., 2012)

7

Pro-vitamin A carotenoid content retention (%) of various processed orange-fleshed sweetpotato products (Source: Tadria et al., 2010)

Sweetpotato variety	Steamed	Boiled	[1a]Inginyo scrapped	[2a]Inginyo un-scrapped	[3a]Amukeke
NASPOT 10 (SPK004/6/6)	87.7±0.9	86.9±1.3	38.8±1.6	24.6 ± 0.3	10.3±0.1
NASPOT 9 (SPK004/6)	88.1±1.9	86.9±1.3	36.2±2.4	29.8 ± 1.5	5.3±0.1
Kakamega (SPK004)	73.0±1.0	75.4±1.8	67.4±3.9	47.1 ± 1.6	8.1±1.0
Ejumula	79.5±2.0	75.4± 1.8	42.1±4.5	31.7 ± 6.6	5.3±0.1

a: open-air sun dried products; 1 – Inginyo is dried product from crashing small-sized OFSP roots;
2 – Modified method for production inginyo by scrapping root skin prior to crashing and subsequent drying;
3 – Dried sliced product from drying large sized OFSP root

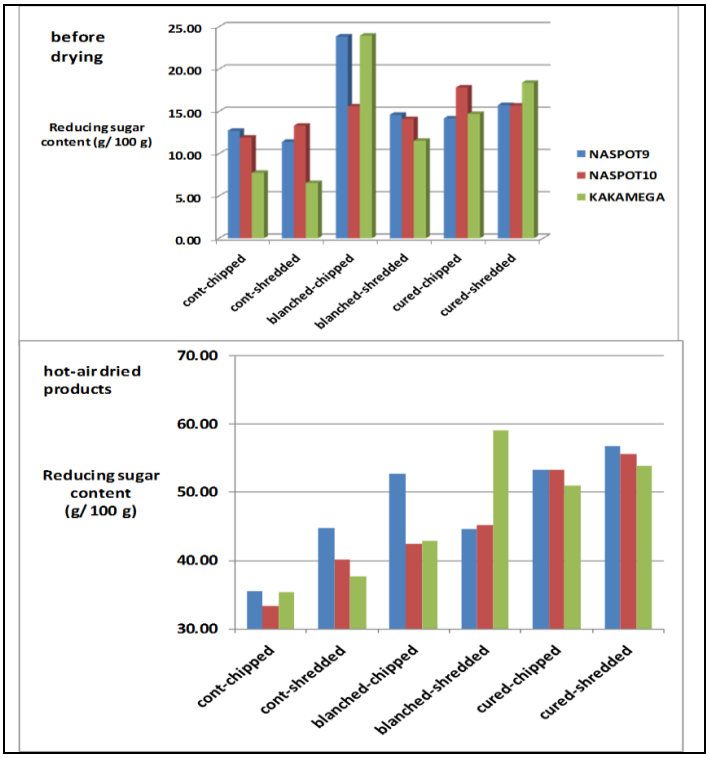


Fig 3. Reducing sugar content of various SP dried products
a) control – roots washed, peeled, chipped/ shredded and hot-air dried at 60°C for 18 h
b) blanched – roots washed, peeled, dipped in hot water (76-80°C for 10 min), drained and cooled, followed by chipping/ shredding and hot-air drying at 60°C for 18 h
c) Cured – roots cured for 3 days at ambient conditions. Roots washed, peeled, chipped/ shredded & tunnel solar dried at 33± 6°C for 36- 48 h

In conclusion consider:

- ❑ Processing and postharvest handling options and appropriate technologies
- ❑ Starch, moisture and reducing sugar contents of processed products

- ❑ Subsequent products to be consumed and marketed

8. <u>Agnes Namutebi and Jan Low. 2014. Discussion in Plenary: Selecting the right product for the right target group (Session 2)</u>

Jan called on the Universal industries(UI) Representative, Jane, to comment on what is the right product for the Malawi market.

A: I came with one thing in mind. Basically I was thinking about biscuits using some sweetpotato flour as a substitute for wheat flour. Trying to think about the introduction of puree or concentrate, this might lead to some real challenges to UI in terms of getting the right equipment. Using the flash dryer for high quality cassava flour production system to produce the same thing for sweetpotato is what she proposes. This still seems to be a feasible idea for us to apply. A further idea is that we pre-pack mandazi and other flours mixes for baked and fried products. Now she thinks that maybe putting sweetpotato into these types of mixes would be a possibility. The challenge will be whether it will be possible to get enough sweetpotato for either process. To produce tons in a day, supply may be a challenge. This is the sort of challenge which arises with cassava, and will probably be the same in sweetpotato. There would also be challenges with seasonality of supply, since sweetpotato and cassava are food and they tend to be in higher demand than UI procurement process had considered. Also, production areas need to be near processing facilities.

Q: Jan follow up, What is the price of cassava versus sweetpotato, which will determine whether it is economically viable?

A: Sweetpotato will still be competitive with the price of imported wheat, and cassava, though cheaper, is not really available.

Comments from Ghana: Francis. Cerelac is sold in 50 g sachets, so market entry is easy for complementary food if you package as done for Cerelac.

Eric also saw opportunities in juice and yogurt.

Ted: mention the breeding objective for W. Africa [Seems like the main staple type sweetpotato is actually the type preferred by W African consumers.]

Agnes comment: We simply need to recognize that there is a range of quality types that have different end-uses.

Q by Agnes: How is the Rwandese factory ensuring supply? After all, farmers need to eat, so they may prefer to eat what is supposed to go to the factory.

A: There is planning with the farmer groups and the factory is willing to pay a slight premium. Diversified production centers and extended season. Jan's comment: We used clean planting material to boost yield and ensure adequate supply.

Jean (SOSSPA): Problems with seasonality are a challenge in Uganda. What are you doing to overcome them in Rwanda.

A: Not all that much problem. Because Rwanda has access to swamps.

Godfrey: What is the success of the packaging and transforming the image of sweetpotato in Rwanda?

Jane Pankuku: The perception that sweetpotato is a poor man's food is likely to be a challenge in Malawi as well. For example, when cassava is included in products in Malawi, the value immediately declines in consumers' eyes.

Kirimi: Our packaging appears to be expensive, but in fact it is highly affordable. It is interesting that we researchers had to work this out, while private sector was busy doing something else. We have products that are available to low end markets and high end markets. We also did a very thorough job

of engaging with media to modify the image of sweetpotato. This has been effective and is an ongoing effort.
Aime - media consultant and TV commentator: It was not easy to change the image, but we are doing it. For example, we do it via TV, radio, print media, and on-line. It seems that the image of sweetpotato has not shifted from Local Defense to something cool. Youth communicate with and market to youth. These are the people to do the marketing.

9. Eric K. Dery. 2014. Integrating OFSP into Existing Food Recipes in Ghana

Introduction

- Ghana has several recipes based on the different regions
- Roots and tubers form major staples of Ghanaian diets
- The popular recipes in Ghana include, e.g., fufu, banku, kenkey, T.Z, ampesi, wakye, and akple

There are two released OFSP varieties known in Ghana:

- Apomuden (Good health)
  - High beta carotene (30-35nm)
  - Low dry matter (18-20%)
- Bohye (Promise)
  - Low beta carotene (5-9nm)
  - High dry matter (29-32%)

CIP involvement in sweetpotato improvement efforts in Ghana

a) Breeding and dissemination
   - National sweetpotato program (CSIR-CRI and SARI)

   Less sweet types are targeted, not strictly OFSP
   - Outreach with Government and NGO partners, e.g. TRAX Ghana

Identifying the consumer knowledge, attitudes and practice about Sweetpotatoes

Conducted Consumer survey (2012)

Study locations: Volta (Ohawu), Central (Komenda) and Upper East (Tono) Regions.

300 respondents: 45.9% male and 49.8% female; age range of 10 – 65 years.

Interview: consumption, benefits of eating sp, preferred mode of receiving promotional information, sp issues of concern

Administered Questionnaires (in markets, homes and on-farm)

- Demographic information
- Assessment of attitude and knowledge
- Problems in sweetpotato farming

Outcome (Findings)

- 97.1% eat SP as snack and not as staple
- Boiling and frying predominant processing forms
- Lack of product diversity
- 74.2% not aware of any programs promoting sweetpotato

- Limited information on health benefits
- Lack of ready market
- Lack of planting materials

Finding solutions:

Extensive seed multiplication program

a) Preparation of lands for OFSP multiplication b) Searching for potential multipliers during the dry season for the next planting season c) Multiplier giving out vines to farmers

Lessons from natives

- Technology
- Recipes

a) Irrigation system by a local farmer in Keta, Volta region
b) Keeping vines for animals
c) Storage system to prevent maize weevil infestations in Denu, volta region
d) Women selecting leaves for soup in Daboase, western region

Developing recipes (Juice, pastries, sweetpotato balls, potaghurt)

Some commercially viable products from OFSP (meat bread, scones, rolls, pie, potaghurt, cake, pudding, crisps)

Generating interest

Community outreach programs (Eastern, Upper east, Volta, and Northern regions)

Hands–on training

- Training of trainees (TOT) across the country
    - Farmers
    - Processors (small scale processors)
    - Market women
    - Agric Extension Personnels
    - Ministry of Food and Agriculture
    - NGO's

Seizing every opportunity: at conferences/meetings, welcoming the media, at hotels and restaurants, village square, sensory program

Routine sensory analysis is done for assessment of breeding materials

Challenges: Limited funds, inadequate staff, and limited number of OFSP varieties in Ghana

Way Forward

- Liaise with Farm Radio and other media outlets in promoting OFSP across the country
- Partner with the hospitality management industry to include OFSP in their recipes for Consumers

- Identify and develop potential markets such as boarding schools, food processors, other institutions and local markets

10. Jean Pankuku. 2014. Developing New Food Products: The perspective of the private sector

Company brief, Universal Industries Limited (UIL)

- UIL, established in 1957, is the leading producer of quality biscuits, confectionery, savory snacks, pre-packs, and beverages in Malawi under their prominent brands
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Manufacturing operations

- 1 manufacturing facility in Mzuzu for beverages
- 3 manufacturing facilities in and around Blantyre for quality biscuits, confectionery, and snacks
- Farming operations near Blantyre
- State-of-the-art plant and machinery from world leaders from Germany, Holland, Italy, and other countries
- 5 warehouses around the country
- Robust distribution network and versatile range of commercial fleet
- Best practices and center of excellence in manufacturing, operations, product marketing, and customer value management following global standards
- Highly competent and professional staff capable of and working on taking the company to the next level

Current Partnerships

- Irish Aid
- Bill and Melinda Gates Foundation (CAVA)
- Business Innovation Facility of DFID
- International Potato Center (CIP)
- Ministry of Agriculture and Food Security
- Government of Malawi

Product Portfolio

a) Biscuit

b) Confectionery – hard boils, bubble gums and chocolate bars

c) Savoury snacks – potato crisps, cassava crisps, extruded snacks and fried pellets

d) Beverages – Orange squash, fruit juices, purified still water, roast and ground coffee and tea

e) Pre-packs – baking ingredients, Anchor milk and ready mix flours

f) Breakfast cereals – Rice puffs, Coco puffs

g) Nutritional foods – Nutri Gluco Phala, Soya chunks and other soya products and peanut butter and peanut butter based RTEF

Company Motto

- To add value to Malawian crops from the soil to the supermarket shelf.

- At the moment the company is focusing on value addition of 6 major crops: Irish potato, cassava, maize, soya, peanut and coffee
- Sweet potato is a new product that will be added after successful trials have been done
- Recently, the company has moved from not only providing the tasty snacks but also providing nutrition to the nation by developing nutritional foods.

New Product Development Defined

- It is the process of bringing a new product into the market which includes improving the existing products or creating new products or presentation of an old product into a new market
- It involves product designing and market analysis
- Product design should balance between the customer needs (nutritional, organoleptic and socio-economical) and product attributes
- Competitive product evaluations provide objective information and translate consumer requirements into product specifications.

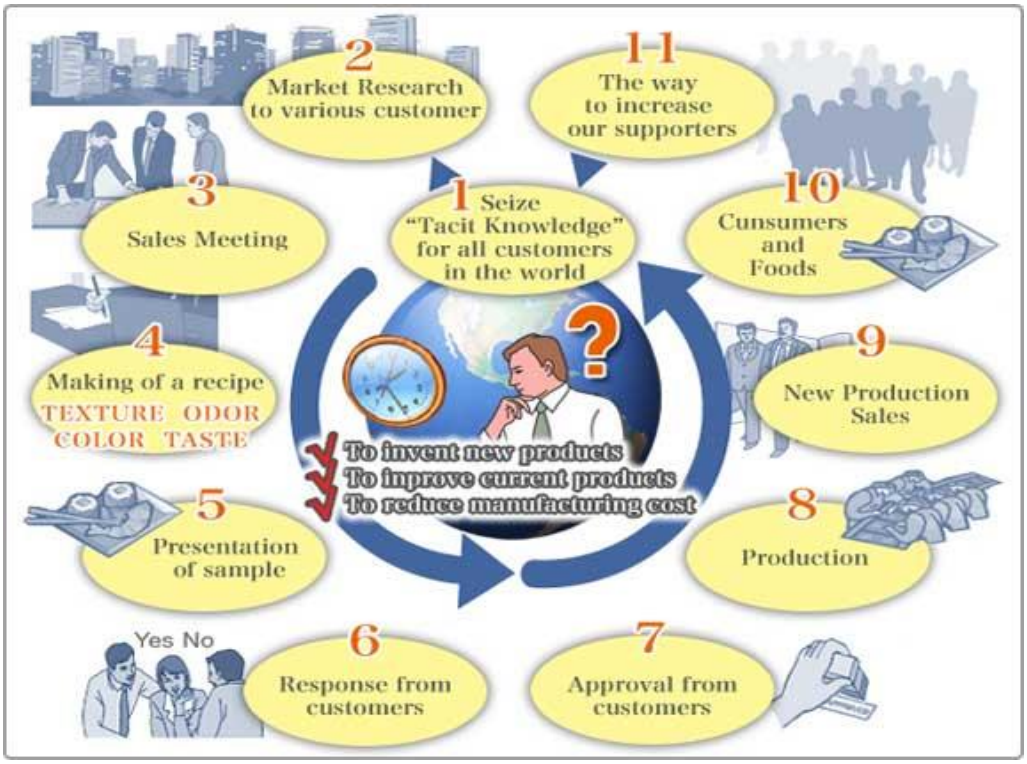
NPD Classifications

- Never – before – seen products
- Innovative and added value products
- New packaging on an old product
- Reformulation of an existing product
- New form of an existing product
- Established product in a new market niche
- Line extension

Reasons for NPD

- New products for current market – growth & profitability
- Diversification – new products for new markets
- Changing habits of consumers
- Competition
- Increased knowledge of food science – preservation, processing and new ingredients
- Health & nutritional needs of the population
- New packaging technology
- To reduce manufacturing costs

What Constitutes Product Development



NPD Process

1. Develop an idea 2. Conduct market research 3. Develop product concept 4. Identify the target customers 5. Develop formulation and conduct lab trials 6. Raw materials & equipment required 7. Conduct trials and sampling 8. Finalize the formulation		9. Product analysis – nutritional, microbiological & physical parameters – this depends on product type 10. Product costing and pricing 11. Registration and certification with relevant government bodies 12. Market sampling

- The process depends on whether you are creating a new product or improving on the existing one.

- The process involves actions, outcomes and decision making based on the outcomes :Product introduction – is done after field trials have been completed and product has been packaged and priced appropriately to convey the correct message of quality and value.

    - Product support – is a complementary milestone that builds product success and repeat business. It provides valuable information for line extensions, product upgrades and creation of new opportunities
    - Food safety is of paramount concern for the success of new products.
    - Implicit to production and introduction of new food products is a total quality program that continuously identifies, analysis and controls risks.

- Risks controlling process begins with hazard analysis of critical control points (HACCP).

Conclusion

- It is worth assessing how a company/organization controls the basic product development process to avoid the following:
    1. Longer product development time
    2. Missed target launch dates
    3. To reduce number of crash projects
    4. A succession of stop/go decisions
- NPD involves all functions of the organization i.e. technical, operational, supply chain, sales and marketing and the entire top management.
- Economics, consumer and competition necessitate NPD
- New products should be consistent with goals and strategies of a business.

Discussion

Q: As a company do you go into production of new products for profit, consumer needs or competition.
A: We go into production because of all the reasons stated above. There is the need to diversify products to over competition.

There was a comment from Gaston on the need for the availability of roots all year round.

11. Jean Anthony Onyait . 2014. Marketing Sweetpotato Flour and Other Products: SOSSPA's Experience in Uganda

SOSSPA Background

- Soroti Sweetpotato Producers and Processors Association (SOSPPA) – is a community based small holder farmers association located in the eastern Uganda, Serere District, 380 Km from Kampala
- Founded In 2006, SOSPPA is comprised of 12 Graduate Farmer Field School (FFS) groups with a membership of 632 [60 % (360)F and 40% (272) males]
- Engage in variety validation, conservation and multiplication of clean seed vines, farmer to farmer training, production/ productivity, processing/ value addition and consultancy
- SOSPPA is a corresponding member of Slow Food International, Sweetpotato Support Platform for East and Central Africa, and a contributor to the Sweetpotato Knowledge Portal (www.sweetpotatoknowledge.org).

SOSSPA's Way

- Promote sustainable sweetpotato production practices for improved household livelihood
- Promoting, facilitating and monitoring the quality of farm produce from members
- Enhancing the competitiveness and marketability of local farm produce
- Training farmers in sustainable agricultural practices

Marketing Sweet potato Flour and other Products

- **Composite flour** (Porridge)
- Confectionaries (Doughnuts, Cakes(Queen cakes, Half cakes), Chapatti, Stripes (bagiya))
- Juice & Jam
- Amukeke

- Iginyo
- Emukaru (Fresh sweetpotato buried in red heated soil for 30 minutes to 24 hours)

Variety	%	Comments
Kakamega (SPK 004)	50	• High dry matter and good for flour for preparing "Atap", • Higher multiplication rate, • Average root yield, • Moderately resistant to SPVD
NASPOT 11	5	• Recent introduction and not widely spread, • Highest dry matter, • Best variety for "Atap"/ kalo • Good shelf-life of chips (6 months), • Moderate root yield,
NB: Percentages show the proportion of the total quantity of material multiplied and conserved for wide dissemination. Excluding the material multiplied and conserved for research and selected local varieties		
Local varieties liked (competition) : Mary , Boy, Tanzania, Socadido, Kampala, ebitepeduno , echichi		

Efforts by SOSPPA and partners in the promotion of OFSP adoption in Uganda since 2004.

1. **Seed system**
   Varieties validated, released, multiplied and distributed:
   -Kakamega (SPK 004)
   -Ejumula
   -Vita (NASPOT 9 O)
   -Kabode (NASPOT 10 O)

   Areas distributed:
   20 Districts: Kumi, Amuria, Katakwi, Bukedea, Kaberamaido, Pallisa, Tororo, Bugiri, Kamuli, Mukono, Abim, Kotido, Kaabong, Moroto, Nakapiripirit, Oyam, Apac, Gulu, Pader and Kitgum

Challenges

- OFSP products are not standardized
- Durability of the products during storage
- Limited finances for promotional activities
- Low adoption by beneficiary communities

- Limited ability to influence policy makers
- Lack of processing equipment and technology

Recommendations

- Product development and packaging
- Market penetration (Good marking that includes Advertising to stimulate product awareness)
- Standardization of flour products
- Let us not market the sweetpotato, we should market the value in sweetpotato (OFSP)

Discussion

Q: How many grams of raw sweetpotato do you need to produce your flour-based products?
A: 4 to 5 kg to get 1 kg of the flour products.
Q: Did you get large numbers of consumers to assess the preference of your flour products?
A: Yes, we conducted consumers' preference test in several places in Uganda.
Q: Did you get enough roots for your product?
A: Yes, we have enough farmers groups to meet our needs.

C. Working Groups (2): Should we create a Technical Group to Tackle Post-Harvest and Processing Issues Concerning Sweetpotato and if so, How Should it Work?

Participants randomly formed two working groups to discuss whether a technical group to tackle sweetpotato post-harvest and processing issues should be formed, and if needed, how such a group should work. The summary of the discussions of the two groups is given below.

Group 1.

- A technical group is needed
- The group needs to include actors along the value chain
- Issues to consider:
  1) Supply of raw materials
  2) Appropriate technologies
  3) Awareness of the nutritional value of products
  4) Quality issues
     -Hygiene
     -Nutritional value
     -Certification issues
  5) A list of labs for nutritional analysis for stakeholders to use
  6) Economic and nutritional values should go hand in hand
  7) Information sharing among actors
  8) A newsletter to share findings on research, and research for development
  9) An electronic means of communication e.g. Webnar,
     - On-line discussion
     Coordinated by one person
     -Meet once a year and share information throughout the year

Group 2

Question: Do we need the Postharvest technical group (PHTG)?
Answer: Yes
-so we can have in depth discussions of PH and processing issues on OFSP and other sweetpotato
-Good forum for sharing information
Question: How should the PHTG work?
Ans: On-line discussions using the Sweetpotato Knowledge Portal (SKP), but have restricted access to PHTG
-Then share information to others via SKP
-To be done quarterly
Issues:
-We need a coordinator
-Share information e.g. on research papers, industrial challenges, need support of CIP to publish via open-access, also to be able to access articles
- Write collaborative proposals for funding
Group 2's first suggestion:
-How do we make sure roots are available all year round?
-Answers will be posted to the platform

D. <u>General Discussion and Way Forward</u>

Discussion of leadership and membership was led by Robert Mwanga. There was general agreement that there ought to be a leader to move the team forward. Madjaliwa Nzamwita of RAB, Rwanda, was proposed by Anthony Onyait to be the person to move forward the group effort. Francis Amagloh was also proposed to lead the group, so, both will co-chair the effort. Agnes Namutebi was also put forward to be the secretary of the group. She agreed as well. As a follow-up, minutes from the meeting will be circulated. Luka Wanjohi was proposed to follow up to facilitate a place on the Sweetpotato Knowledge Portal for quarterly communication.

Follow up action on Technical Group to Tackle Post-Harvest and Processing Issues Concerning Sweetpotato: will be by Madjaliwa Nzamwita (Co-Chair), Francis Amagloh (Co-Chair), and Agnes Namutebi (Secretary)

Robert thanked all for participating and wished all well during the field day due the following day.

E. <u>Some observations noted on the field day, 30 January 2014</u>

Observed at one site, three net tunnels (each net tunnel was 2.5 length x 1.5 width x 1.5 m high) with farmer group, KOTEMU, planted 17 May 2013

Farmers had cut a total of 1,300 vines from NASPOT 10 O and 1,200 vines from NASPOT 9 O from the net tunnels.

The farmers said that vine cuttings from the net tunnels gave higher root yields compared to their own vines. RAB provided the clean vines which they planted in the net tunnel. The farmers prepared the land, added organic matter and planted a total of 217 vine cuttings, 30 cm length, at 10 x 30 cm distance. They applied insecticide and watered during the dry period. Every time they opened the net

tunnel, they observed recommended agronomic practices, such as weeding, and applying insecticide. The first cutting was done at three months after planting, then the 2nd cutting was done two months after the first cutting. The area is safe; they do not have loose animals to graze the vines. The group gives vines free to their immediate neighbors but sell to other farmers and people who come from far. The income from vines and roots is used for school fees and for buying household items. One bundle of vines (about 20 kg or 2,000 vine cuttings) is sold at about 5,000 Rwanda Francs. NASPOT 9 O and NASPOT 10 O mature earlier (at about four months) than the local popular variety, Tula, which matures at six months after planting. Tula yields about 7-8 t/ha while NASPOT 9 O and NASPOT 10 O yield about 16 t/ha. The root yields from the valleys are higher than the yields from the hill slopes.

Photos taken during the field day are at the Sweetpotato Knowledge Portal; below are Turwanyubukene farmers' group and SINA factory.

Turwanyubukene farmer's group Members at Imbaraga office

Chairperson of Turwanyubukene farmer group explaining how sweetpotato varieties, Ukerewe, Gihungumuhungu and Cacaerpedo are used in processing

Annex 1. Agenda

8th Sweetpotato Support Platform Meeting
For East and Central Africa:
Sweetpotato Post-Harvest Management and Agro-processing
Chez Lando, Kigali, Rwanda,
January 29-30, 2014

Jan 28 Tues	Arrival of participants	Jean Ndirigwe & Jean-Claude Nshimimiyana
29 Jan, Wed **Session 1**	Chair / Rapporteur	J. Ndirigwe & Ted Cary(chair)/ Robert Mwanga (rapporteur)
8:00-8:15	Registration	Emily Ndoho
8:15-8:30	Introductions	J. Ndirigwe
8:30-8:45	Welcome Remarks	Jean Jacques Mbonigaba Muhinda
8:45-9:30	Sweetpotato product development in Rwanda: Lessons Learned to Date	Kirimi Sindi and Jean Ndirigwe
09:30-9:50	Developing sweetpotato-based weaning foods: Technical and Cost Considerations	Francis Amagloh
9:50-10:30	Group photo and Health Break	
Session 2	Chair/Rapporteur	Agnes Namutebi/Ted Carey
10:30-11:05	The Challenge & Opportunities for Sweetpotato Post-Harvest Utilization in SSA	Jan Low
11:05-11:25	Determining Bioaccessibility of pro-Vitamin A from Sweetpotato Products	Gaston Tumuhimbise
11:25-11:45	Using and Storing Sweetpotato Puree & Concentrate: What Have We Learned So Far	Antonio Magnaghi

11:45-12:30	Discussion in Plenary: *Selecting the right product for the right target group*	Agnes Namutebi & Jan Low
12:30-14:00	**Lunch**	
Session 3	Chair/Rapporteur	Kirimi Sindi (chair)/Francis Amagloh (Rapporteur)
14:00-14:20	Integrating OFSP into Existing Food Recipes in Ghana	Eric Kuuna Dery
14:20-14:40	Developing new Food Products: The Perspective of the Private Sector	Jean Pankuku, Universal Industries, Malawi
14:40-15:00	Marketing Sweetpotato Flour and Other Products: SOSSPA's Experience in Uganda	Anthony Onyait
15:00-16:20	2 Working Groups: Should we create a Technical Group to Tackle Post-Harvest & Processing Issues Concerning Sweetpotato and if so, How Should it Work?	Francis Amagloh & Kirimi Sindi
16:20-17:00	Feedback of Working Groups to the Plenary	Francis Amagloh & Kirimi Sindi
17:00-17:30	General Discussion and Way forward	Jan Low
30 Jan, Thurs	**Day 2, Field Trip**	**Jean Ndirigwe, Kirimi Sindi**
Depart 7 am	Visit SINA Enterprises for bakery visit & biscuit & juice production demonstrations & farmer organizations selling roots & products; net tunnel vine selling	Antonio Magnaghi & Faustus (SINA)
31 Jan	Departure unless participating in the SMT meeting	

Field Visit Schedule, Thursday, 30 -01- 2014

Departure: 8:00 am fromHotel Chez Lando

Time	Activity	Location	Responsible
8:00-9:00	Departure from Hotel Rulindo		Ndirigue, Kirimi, Jean Claude
9:00-10:00	Visit one farmer group KOTEMU (1st group): Net tunnels & root production Visit one contracted farmer (2nd group): root production	Rulindo District	Consolee, Afrika, Faustin, Jean Claude
10:00-11:00	Visit one farmer group KOTEMU (2nd group): Net tunnels & root production Visit one contracted farmer (1st group): root production	Rulindo District	Consolee, Afrika, Faustin, Jean Claude
11:00-11:15	Departure to Gakenke District		
11:15-12:00	Visit to Turwanyububukene farmer group (processing)	Gakenke District	Consolee, Afrika
12:00-12:15	Departure to SINA factory		
12:15-13:30	Visit SINA factory: processing demonstration (juice & other bakery products)		Faustin, Antonio
13:30-14:30	Lunch	SINA	Faustin
14:30	Departure from Nyirangarama to Kigali		

Annex 2. Results of Evaluation of the 8th Sweetpotato Support Platform (SSP) Meeting for East and Central Africa: Sweetpotato Post-Harvest Management and Agro-processing, Chez Lando, Kigali, Rwanda, January 29-30, 2014 (12 participants out of 33 evaluated the meeting, others did not go for the field trip or left before the field trip ended**)**

1. Did the meeting match your expectations?	1-Not at all 2-Somewhat 3-Most 4-Completely	100% of participants said the meeting met their expectation mostly (41.7%) and completely (58.3%)
2. How would you rate the quality of the meeting in terms of content?	1-Very poor 2-Poor 3- Alright 4-Good 5-Very good	The quality of the meeting in terms of content was rated by participants as very good (50 %) or good (50 %)
3. Overall, how would you rate the meeting in terms of organization (logistics, communication)?	1-Very poor 2-Poor 3- Alright 4-Good 5-Very good	Organization was ranked good (50%) to very good (50%) by participants
4. How would you rate the quality of the field trip in terms of content	1-Very poor 2-Poor 3- Alright 4-Good 5-Very good	41.7% ranked the quality of the field trip as very good, 50% good and 8 % alright
5. How would you rate the quality of the field trip in terms of organization	1-Very poor 2-Poor 3- Alright 4-Good 5-Very good	41.7% of participants ranked the organization of the field trip very good while 16% ranked it alright.
6. Please list the 3 parts of the meeting that were most useful to you		
a) both days- field trip was essential b) discussion sessions c) individual presentations to set the pace d) the lessons learned presented by Rwanda e) private sector perspective f) customer led innovations g) visiting Sina's factory to see the production we have been hearing about h) meeting people interested in post-harvest i) learning about partnerships j) product development k) marketing and branding l) networking m) presentation by researchers n) presentation by private sector o) processing, beta-carotene retention		

p) juice processing
q) the meals
r) work group session on post-harvest technical team
s) experiences of different countries

7. Please list the 3 parts of the meeting that were least useful to you

a)group discussion
b) presentation about the future
c) some nutritional technical subjects were irrelevant
d) splitting 2 groups (1 group was enough)
e) field excursions to augment the class room meeting
f) field visits
g) computer theft

8. Please suggest 3 areas for improvement or topics you would like to see in the next meeting

a) focus on storage
b) updates on product development processes
c) include more actors along the value chain
d) discussing exchanging experiences
e) time of meeting was not enough (make it more than 2 days)
f) someone from government or ministry should give presentation
g) mechanized cottage plants/ industries
h) efficient low cost drying of OFSP to retain beta carotene
i) marketing challenges / opportunities
j) more presentations from private sector
k) progress on OFSP research
l) more presentations on food product development
m) factory should have prepared better
n) economic aspect of using OFSP
o) o) More institutional involvement

9. Additional comments

a) In general the meeting was useful
b) Keep the group running and share any necessary information
c) It was a wonderful sharing opportunity
d) It was useful

Sweetpotato Support Platform for East, Central and Southern Africa Sweetpotato Seed Systems Consultation Meeting, January 29 - 30, 2014

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