RESEARCH PROGRAM ON Roots, Tubers and Bananas

CGIAR

Demand-led Approaches To Drive Post-Harvest Innovation And Nutritious RTB Products

Strategy Development Workshop

Date: **June 8-9, 2017**

Venue: **Imperial Botanical Beach Hotel**
Entebbe, Uganda

LED BY

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RTB Workshop Report

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Abbreviations

Bioversity	Bioversity International
CHAIN	Coalition for Health Agriculture and Income Networks
CIAT	International Center for Tropical Agriculture
CIP	International Potato Centre
CRP	CGIAR Research Program
EU	European Union
FGD	Focus Group Discussion
FP	Flagship Program
IFAD	International Fund for Agricultural Development
IIRR	International Institute of Rural Reconstruction
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
MAAIF	Ministry of Agriculture, Animal Industries and Fisheries
NARL	National Agricultural Research Laboratories
NARO	National Agricultural Research Organization
NPV	Net Present Value
NRI	Natural Resources Institute
PHL	Postharvest Losses
PIM	CGIAR Research Program on Policies, Institutions and Markets
PMCA	Participatory Market Chain Approach
PPM	Pig Production and Marketing Ltd
RH	High Relative Humidity
RTB	Roots, Tubers and Bananas
SME	Small-Medium Enterprise
SP	Sweet Potato
SPV	Sweet Potato Vines
UFVEPA	Uganda Fruits and Vegetable Exporters and Producers Association
VC	Value Chain
VCD	Value Chain Development
VEDCO	Volunteer Efforts for Development Concerns
ZARDI	Zonal Agricultural Research Institute

Demand-led Approaches To Drive Post-Harvest Innovation And Nutritious RTB Products

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June 8 – 9, 2017

1. BACKGROUND

The strategy development workshop in relation to the Cluster CC4.1 of the CGIAR Research Program (CRP) on Roots, Tubers and Bananas (RTB), entitled "Demand-led approaches to drive post-harvest innovation and nutritious RTB products" and held in Entebbe, Uganda on 8-9 June 2017 brought together 26 participants from various research and development organizations across Africa, Asia, Latin America, and Europe. Under the leadership of the International Institute of Tropical Agriculture (IITA), participants represented Bioversity International (Bioversity), the International Center for Tropical Agriculture (CIAT), the International Potato Center (CIP) IITA, and other strategic partners including Federal Ministry of Agriculture, Nigeria and Natural Resources Institute (NRI) from Greenwich University, UK.

The workshop had the following objectives:

- Identify researchable issues that cut across RTB crops and centres; further develop the research portfolio within the cluster CC 4.1, and better shape the vision
- Identify key public and private-sector partners, brainstorm on their potential role in postharvest innovation and nutritious RTB products implementation, and define essential mechanisms for effective research collaboration
- Brainstorm on a mechanism of how we link with other clusters in FP4, FP2 and FP5, and how we envision joint resource mobilization
- Develop an implementation and resource mobilization strategy for the period 2018-2022
- Develop and outline a plan of action for the remaining period of 2017

The workshop allowed to share experiences, learn from one another and to advance the RTB cluster CC 4.1 team implementation and resource mobilization strategy, including ideas that cut across crops and centers. The workshop was held back-to-back with a two-day workshop of the RTB-ENDURE project (6-7 June 2017) to incorporate the lessons learned into the cluster portfolio, consolidate the linkages between cluster CC4.1 and other clusters in FPs 4 and 5, and develop strategies for implementation and joint resource mobilization.

The workshop was structured around small facilitated working groups, presentations and plenary discussions to allow all participants to engage in practical discussion. A key note was delivered by two colleagues from NRI – Ben Bennett and Keith Tomlins – who provided an overview and insights into current advances in RTB postharvest innovations across the globe. Feedback from the workshop was very positive as participants saw great prospects for cross-crop and cross-center collaborations, harnessing linkages between the clusters within FP4 and across other FPs in addition to bringing on board other strategic partners along the value chains. This report provides an overview of the workshop, background information and objectives, a summary of the presentations and discussions, and suggestions for next steps.

1.1 OBJECTIVES

- Identify researchable issues that cut across RTB crops and centres; further develop the research portfolio within the cluster CC4.1, and better shape the vision
- Advance the research ideas with a view on key public and private-sector partners, their potential role in postharvest innovation and nutritious RTB products implementation, and essential mechanisms for effective research collaboration.
- Brainstorm on a mechanism of how we link with other clusters in FP4, FP2 and FP5
- Develop an implementation plan and resource mobilization strategy for the period 2018-2022
- Develop an outline plan of action for the remaining period of 2017

1.2 AGENDA

Thursday, June 8

Time	Topic	Resp.
8:00-8:30	Registration	Richard Ofei/Sarah Mayanja
	Moderator	Busie Maziya-Dixon
8:30-8:40	Welcome remarks	Simon Heck
8:40-9:00	Goodwill message	Dietmar Stoian
		Thierry Tran
		Ben Bennett
9:00-9:10	Workshop overview/objectives and adoption of the agenda	Busie Maziya-Dixon
9:10-9:30	Introduction to RTB CRP and FP4	Simon Heck
9:30-9:45	Overview of CoA 4.1 Demand-led postharvest innovation	Busie Maziya-Dixon
9:45-10:00	Discussion	Participants
10:00-10:30	Coffee/Tea break	
10:30-12:30	**Moderator**	**Diego Naziri**
	Inputs for consideration from ENDURE sub-projects and their	

Time	Topic	Resp.
	relevance to CoA4.1	
	Banana	Enoch Kikulwe, Bioversity
	Cassava	Kelly Wanda, IITA
	Sweet potato	Gerald Kyalo, CIP
	Potato	Sam Namanda, CIP
	Reflections on ENDURE achievements	Dietmar Stoian
	Lessons learnt from ENDURE project	Diego Naziri
	Discussion	Participants
12:30-14:00	Lunch	
	Moderator	**NRI**
14:00-14:30	Current advances in RTB postharvest innovations	Ben Bennett/Keith Tomlins
14:30-14:45	Discussion	
	Moderator	**Dietmar Stoian**
14:45-16:30	Working session in smaller break out groups, with guiding questions: what is already being done in postharvest innovation? What is missing? What are the 3-4 outputs for your product?	
	Group 1: Consumer profiles and quality characterization of RTB's for targeting end-user preferences.	Keith Tomlins
	Group 2: Product development, improved processing, and nutrition interventions of bananas, potato, and yam	Tawanda
	Group 3: Post-harvest technologies and management options for RTB post-harvest loss reduction and value-addition to waste products.	Diego
	Group 4: Inventory and information dissemination platforms for RTB post-harvest technologies	Thierry
16:30-17:00	Plenary	
	Close of day	
18:30-20:00	**Cocktail**	

Friday, June 9

Time	Topic	Resp.
	Moderator	**Thierry Tran**
8:00-8:15	Recap of previous day	Fred Grant
8:15-8:45	Implementation plan and resource mobilization strategy	Simon Heck
8:45-9:00	Discussion	
9:00-9:15	Brainstorm on a mechanism of how we link with other clusters in FP4, FP2 and FP5	Thierry Tran
9:15-10:00	Advancing the research ideas with a view on key public and private-sector partners, their potential role in postharvest innovation and nutritious RTB products implementation, and essential mechanisms for effective research collaboration.	Dietmar Stoian
	Banana group	
	Cassava group	
	Sweet potato group	
	Potato group	
10:00-10:30	Coffee/Tea break	
10:30-12:30	Cont. of group work	
12:30-14:00	Lunch	
	Moderator	**Enoch Kikulwe**
14:00-15:00	Plenary: feedback from group work	
15:00-15:30	Coffee/Tea break	
15:30-16:15	Develop and outline a plan of action for the remaining period of 2017	Busie Maziya-Dixon
16:15-16:30	Closing remarks	Dietmar Stoian
		Simon Heck
	Vote of thanks	Busie Maziya-Dixon

Meeting minutes

2. PROCEEDINGS OF WORKSHOP DAY ONE

The principal activities on day one, 8 June 2017 included introducing the participants to RTB CRP and FP4, overview of CoA 4.1, overview of the RTB-ENDURE Project and sharing of lessons learnt from the four sub-projects (banana, cassava, potato and sweet potato) and current advances in postharvest innovation. The day ended with participants identifying principal post-harvest innovations and possible gaps.

The workshop started with a welcome address from Simon Heck of CIP, the leader of FP4. Goodwill messages were given by Dietmar Stoian of Bioversity International, Thierry Tran of CIAT, and Ben Bennett, Deputy Director of NRI.

In his message, Ben acknowledged the good collaboration his institute has had with RTB over the period and said individual countries have begn funding research and suggested the cluster and RTB could take advantage of this opportunity. According to him, donors are demanding to see impact in a shorter space of time in comparison to what pertained previously and we need to adapt to these demands. Ben said postharvest losses is on the world agenda because a director of one of the world's biggest conservation organisations Worldwide Fund for Nature in his presentation at the Imperial College of London, where one of its major donors was present, made a passionate plea for reduction in post harvest losses. Such a statement at such a forum has put postharvest losses on the world agenda and we can take advantage of it.

Busie Maziya-Dixon, IITA senior scientist and cluster CC4.1 leader, gave an overview of the agenda and the purpose of this workshop.

2.1 INTRODUCTION TO FLAGSHIP PROJECT 4

Presented by Simon Heck, CIP (fepq0uo5ldj5mq0)

Simon Heck, the leader of Flagship Project 4 introduced the participants to the FP4 goal, objectives, outputs, development outcomes and the way forward for the flagship. Simon revealed that FP4 focuses on "Nutritious RTB Food and Value Addition through postharvest innovation". FP4 is one of the five FPs under the CRP RTB. Others FPs are;

1. FP1: Enhanced genetic resources
2. FP2:Productive varieties and quality seeds
3. FP3: Resilient crops
4. FP 5: Improved livelihoods at scale.

Research goal for FP4 is supporting the fuller, equitable, and sustainable utilization of RTB crops. The research is based on two drivers which include putting consumer (end user) at the

center with a focus on changing nutrition needs, diet preferences and gender responsive; and changing market demands by looking at processing technologies, urbanization, environment and gender.

FP4 is structured under four clusters. These include;

1. CC4.1: Demand-led approaches to drive post-harvest innovation and nutritious RTB products under the leadership of Busie Maziya-Dixon.
2. CA4.2: Raising incomes and improving the health and safety at small and medium cassava processing centers under the leadership of Thierry Tran.
3. CA4.3: Biofortified cassava varieties for improved nutrition and livelihoods under the leadership of Elizabeth Parkes.
4. SW4.4: Nutritious sweet potato for expanding markets and healthier diets under the leadership of Robert Ackatia-Armah

Moving Forward

The 2017 FP 4 outputs for all the four clusters were highlighted. This workshop focused on the research output for CC 4.1 which is “Lessons learned from RTB-ENDURE and the way forward for RTB post-harvest business cases”. This will involve synthesis of lessons learnt and documenting critical gaps that may hinder uptake of innovations generated from RTB- Endure and assessment of performance of a gendered PMCA process (e.g. generation of innovations) for lessons in reducing post-harvest losses and scaling out.

The participants were encouraged to devise means and mechanisms of strengthening the linkages between FP4 clusters considering cross-crop learning on shared challenges and convening role of cross-cutting cluster to be developed; linkages between FP4 and FP2 (breeding) and developing linkages with FP5 (scaling) by making an analysis of scaling approaches for and by FP4 (e.g. OFSP; training and Capacity Development strategy for cassava processing, etc), strengthening gender consideration in CA4.2, foresight modelling of adoption of processing technologies and partnership models. A strong need to link with other CRP’s such as Agriculture for Nutrition and Health (A4NH) and Policies, Institutions and Markets (PIM) was also emphasized.

Critical issues to be addressed by FP4 in 2017 were highlighted, including:

1. Defining the research agenda for cross-crop research
2. Identifying the near-term opportunities ("quick wins") for adapting technologies or methodologies to additional RTB crops (e.g. puree, waxing, etc.)
3. Improving capture and sharing of new knowledge generated (beyond reporting) to facilitate linkage between communities of practice
4. Strengthening the role of Cluster Leaders as ‘go-to persons’, effective communication of role and expectations and ensuring regular interactions within Cluster Team.

Questions and Discussion

- Why the cluster focused on SMEs and did not include large enterprises as next-users. In response, it was noted that the proposal focuses on SMEs and targeted vulnerable groups. It was also observed that once small enterprises in RTB are supported to be more competitive, then there is a high possibility of their transformation into large scale enterprises.
- CA4.2 focused on cassava alone yet RTB-ENDURE worked on other crops such as potatoes, sweet potatoes and Bananas.
- CC4.1 handles postharvest issues of potato, banana and yam since there are clusters for cassava and sweetpotato

2.2 Overview of CoA 4.1: Demand-led Postharvest Innovation and Nutritious RTB Products

Presented by Busie Maziya-Dixon, IITA (l2q960xol51byfp)

Busie Maziya-Dixon, the Cluster Leader of CoA 4.1, provided in-depth insights on the focus of CoA 4.1 in terms of the goal, geographical coverage, development outcomes, products, integration of gender and prospective partnerships. She noted that the cluster aim is to "Improve food and nutrition security and diets and provide income and employment opportunities for households". It covers Africa, Asia and Latin America with a purpose of accelerating RTB postharvest innovation and nutrition improvement by integrating technology, social and economic research.

The rationale behind the cluster is to harness the untapped potential for improving processing, enhancing postharvest management and reducing postharvest losses of RTB crops; target the changing needs and preferences of emerging urban markets through product and value chain development and enable producers and processors to increase food safety and quality. The cluster also provides support to crop clusters inside FP4 and enables effective linkages with postharvest and nutrition related research in FP2, FP3, and FP5. The key partners were identified as NGOs and NGO-led programs, commercial food processing enterprises, A4NH, Women's processor associations, Farmer groups/Associations and lead farmers, Natural Resource Institute (NRI) - UK, commercial processors and machinery manufacturers and fabricators. The integration of gender was emphasized noting that gender responsive approaches will be developed and applied throughout all capacity development interventions. This will also include developing and strengthening the capacity of boys and girls to develop as entrepreneurs for small businesses along the postharvest value chains.

Lead and Linked products under CoA 4.1

Lead Product were categorized into four groups as presented below:

- Lead product LP4.1.0: Lessons, tools and metrics to support development of nutritious and value-added RTB products

- LP 4.1.1: Consumer profiles and quality characterization of RTB's for targeting end-user preferences.
- LP 4.1.2: Product development, improved processing, and nutrition interventions of bananas, potato, and yam
- LP 4.1.3: Post-harvest technologies and management options for RTB post-harvest loss reduction and value-addition to waste products.
- LP 4.1.4: Inventory and information dissemination platforms for RTB post-harvest technologies

This cluster has a theory of change which contributes to the following RTB IDOs

1. Improved diets for vulnerable populations (women and children<5 yrs.)
2. Consumption of improved diverse diets that include nutritious RTB food products
3. Reduced pre and post production losses
4. Diversified enterprise opportunities

Questions and Discussion

- There is the need to define the different categories especially SMEs and large scale enterprises
- Within the SMEs there are different categories thereby requiring different interventions.
- SMEs in Nigeria are categorized as such based on the number of employees. Working with large scale enterprises was observed to be important in terms of screening varieties and providing models to learn from for equipment fabrication.
- Cluster 4.1 should focus on SMEs as large companies have capacity to carry out their own research and develop technologies.
- Regarding the research questions and geographical location, it was argued that there was need to remain flexible and open minded and that research centers can determine the location or study area where their research questions would be better answered.

2.3 INPUTS FOR CONSIDERATION FROM RTB-ENDURE SUB PROJECTS AND THEIR RELEVANCY TO COA 4.1

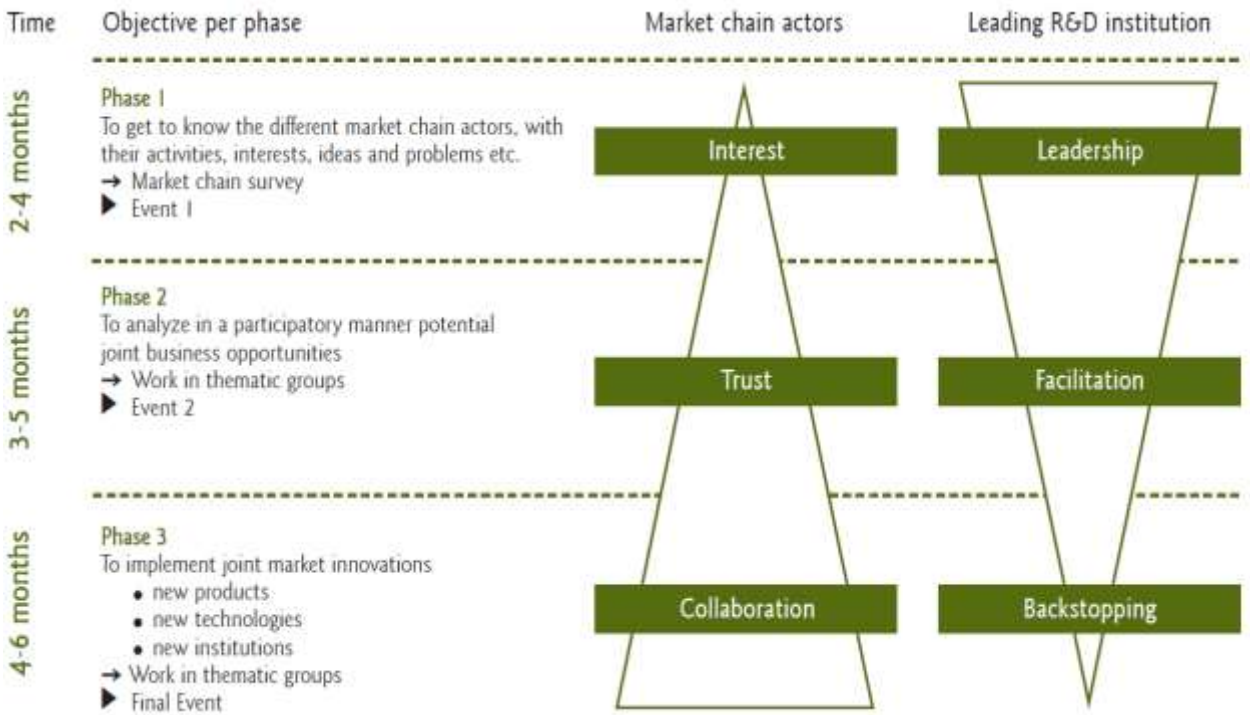
Presented by Diego Naziri, CIP (/j5s2x2ekhqe0j5s)

Diego Naziri, the CIP/RTB Project Leader gave an overview of the "*Expanding Utilization of RTB and Reducing Their Postharvest Losses (RTB-ENDURE) Project"* implemented in Uganda between January 2014- December 2016. He revealed that the bulkiness and high perishability of RTB crops coupled with poor postharvest handling and lack of processing & storage facilities result in short marketing channel, high post-harvest (PH) losses and limited value addition, provided the rationale for the project. The project used the cross-crop and cross-center collaboration approach involving the International Potato Center (The project Lead), Bioversity

International, IITA, CIAT and CIRAD plus a wide spectrum of research-for-development stakeholders and partners including ILRI, 5 NARI, 3 Universities, 5 NGOs, Extension and other local authorities, private firms, exporters and farmers' organizations. The objective of ENDURE was to "*Improve food availability and income generation through better postharvest management and expanded use of RTB".*

The Participatory Market Chain Approach (PMCA), developed by CIP, was used to help smallholder farmers link up with profitable markets by **stimulating innovation process and long-term partnerships** among farmers, marketers , and service providers. Participants jointly **identified**, **analysed**, and **exploited** new market opportunities and this process facilitated the development of marketing innovations, technological innovations and institutional innovations. Steps that were followed in the project are as presented in figure below.

Figure 1: Illustration of the three phases followed by RTB- ENDURE



RTB-ENDURE sub-projects

1. Reducing post-harvest losses and promoting product differentiation in the cooking banana value chain, led by Enoch Kikulwe from Bioversity International
2. Postharvest innovations for better access to potato markets, led by Monica Parker from CIP
3. Improving the utilization of sweetpotato and other root and tuber crops residues as pig feeds, led by Gerald Kyalo from CIP

4. Extending the shelf life of fresh cassava roots for increased incomes and postharvest loss reduction, led by Abass Adebayo from IITA.

Success of ENDURE project is seen by the fact that the lessons are being used by CoA 4.1 to refine the cluster.

2.3.1 Banana Endure Sub-Project: Synthesis of key achievement and next steps

Presented by Enoch Kikulwe, Bioversity (s/o8efacbswrmmlu6)

Reducing post-harvest losses and promoting product differentiation in the cooking banana value chain: key research findings, research outcomes and proposed next steps.

Key Findings of the Project

- High post-harvest losses (up to 13%) along the entire VC
- Mismatches between the banana cultivars farmers grow, those produced by input suppliers, and those preferred by the market
- Gender inequalities in resource access and utilization constraining the participation of women in profitable nodes of the VC
- Established optimum harvest age for one popular cooking banana cultivar Kibuzi (133-150 days) & optimum storage temperatures (peeled –at 10-18ºC for 5 days compared to a few hours & unpeeled-12-18ºC for 12 days compared to 5 days at room temperature

Key Research Outcomes

- Using micropropagation chamber technique, one commercial seed production farmer group with 22 members (10 women and 12 men) has increased their acreage with market-demanded varieties (longer shelf-life) and have sold approx. 3200 in six months.
- One female trader (who was only farming) has accessed the export market by using unpeeled fingers and proper post-harvest practices (proper harvesting, cushioning, hygiene, etc.), which were promoted by the project, supplying about 150 boxes (@10kg) per week, allowing her to generate about $1,000 after 6 months.
- One retail woman is serving customers faster (reducing the waiting time by 15 minutes) with peeled bananas from the new technology she has adopted, including a premium to the prices she fetches.

Proposed Next Steps

Technology	Stage in Innovation Trajectory	Next Steps
Charcoal cooler	Initial) Prototype stage: testing has been done with one woman retailer • Performance test • Temperature ranges	Further testing required • Testing with more traders • Testing at farm level • Design improvement(efficiency improvement) • Different sizes • Alternative fuel sources for evapo-cooling • Cost Benefit Analysis
Differentiated forms (peeled and unpeeled fingers, clusters and protected bunches)	Initial prototypes tested with a few traders	• Testing with consumers in various market segments • Testing peeled bananas with natural preservatives; with vacuum sealing (currently peeling under water, blot and seal- no preservatives- stored for 5 days) • Test peeling at source –work with banana union- need for farmer organisation • Utilisation of residues- banana wastes chain • Test more varieties -storage temperatures and optimal harvest stage

Questions and Discussions

- Factors responsible for the mismatch between banana varieties grown and market demand is lack of up-to-date and precise market information on the part of the farmers. Using an integrated approach, stakeholder meetings were held involving key value chain actors in the meetings, it was established that the varieties were already being grown but not in major volumes due to limited market information – farmers were not aware of emerging markets that demand certain varieties, especially high-end and export markets that require longer shelf life.
- Further analysis is needed to establish the actual post-harvest losses in terms of physical and economic losses.
    - physical losses include ripening and occur principally during production, but also during transport and at retail level;
    - economic losses occur when bananas are bruised, resulting in lower prices; this kind of losses are more severe in the post-harvest stages due to inappropriate transport, storage and handling.

- Regarding the validation of the charcoal cooler, temperature monitoring over one month revealed that temperature varies inside the cooler, leading to uneven results in terms of shelf life increase.
- A gender specialist was involved in the project who managed the integration of gender in all steps of value chain development. As a result, women have become the champions of the project innovations.

2.3.2 Potato ENDURE Subproject: Synthesis of key achievement and next steps

Presented by Sam Namanda, CIP (s/uktq9zspc31cde1)

Postharvest innovations for better access to input and output potato markets: The project involved building of stores, training entrepreneurs, stores management and developing business plans and in addition, testing storability of different varieties.

The key research findings

- Potato shelf life extended to 9 weeks in-storage (MSc. studies)
- Identified genotypes with long dormancy suitable for storage
- Identified genotypes good for processing
- Ox-drawn potato lifter reduces damage and eases harvesting and reduce labour demands on men and women

Key Research Outcomes

- Farmers can store ware potato (e.g. up to 4 months at MIFA) which increases food security and income of farmers.
- There has been improved Association cohesiveness increasing women's participation in leadership of associations.
- The Ox-drawn potato lifter has helped reduce harvesting time per acre (2 acres per day) by the farmers using the technology.

Next Steps

Technology	Stage in Innovation Trajectory	Next Steps
Ware potato storage and management techniques	Prototype development	Opportunity to consolidate knowledge and generate strong reliable data for economic viability and assess quality of stored potato Develop alternative low cost ambient ware potato store • What are the appropriate store sizes for the different stakeholders including women and men smallholder and traders in the value chain?

		• What is the economic viability of ware potato stores? • What is the performance of the different genotypes in storage? • Men and women farmers and traders involved in evaluation of stores and social acceptability.
Mechanised harvesting methods	Pre-prototype	• Validate preliminary results with wider audience • Train artisans and operators • Promote suitable mechanized harvesting practices • Evaluation of technology appropriateness and acceptability by men and women users
Improved packaging practices		• What are the appropriate packaging practices? • What are the packages preferred by consumers and for what uses? • Trader willingness to adopt the improved practices • Promote suitable packaging materials • Identify business opportunities for packaging materials • Acceptability of different packaging option by men and women in different value chain node

Questions and Discussions

- How were partners replicating the storage technology
    - Technology was borrowed from Kenya where it was already working well.
    - It was cheaper to hire a contractor to build the storage facility but it was not good for scalability hence in the project the team opted to build it with the beneficiaries which ended being more expensive.
    - The prohibitive cost will hinder the uptake of the technology even though the desire to adopt it exist.
- Controlled atmosphere storage technology is an option which can be considered in the future

2.3.3 Sweet potato ENDURE SUB-PROJECT

Presented by Gerald Kyalo, CIP (s/j2ozyqy7bfskx71)

Improving the utilization of sweetpotato and other root and tuber crops residues as pig feeds:. The project was implemented by CIP in Kamuli and Masaka Districts.

Key findings of the project:

- Traditional feeding practices result in poor growth rates of pigs
- sweetpotato residues are the most common feed for pigs
- All SPS diets have ample crude protein levels for growing pigs**.**
- A substantial amount of vines, roots and peelings are wasted at farm level
- NASPOT 11 was identified as a suitable dual-purpose SP variety
- Appropriate supplementation for pigs is 60% silage: 40% maize soybean diet
- Silage is currently sold at about UGX 400/kg but farmers are willing to pay up to UGX 600/kg.
- Entrepreneurs are willing to invest in SPS

Key Research Outcomes

- Pilot and trained farmers are using SP silage
- As a result of feeding pigs on silage, farmers have increased their herd size and, income from piggery has improved.
- SPS technology has been an avenue for engaging youth in Agriculture (e.g. Twekembe youth group made and sold 18.5 tons of SPS in 2016).
- SPS centres have started and are offering silage services at a fee.
- Engaging private sector (PPM) has improved the pig value chain (especially marketability for pigs)

Next Steps

Technology	**Stage in Innovation Trajectory**	**Next Steps**
Sweetpotato based RTB composite silage for livestock feed	- Market ready for pig feeds -Prototype for other livestock and RTB crops -Piloted in Kenya, Uganda, Vietnam and China	• Scaling out SPS technology through; 1. business plans, 2. silage centers, 3. dissemination of the technology within Uganda and the great lakes region • Test silage based diet feed with other livestock e.g. cattle • Reformulation of SPS for profitability and nutritional outcomes • Evaluate silage diets in combination with other RTB residues •

Sweet potato root storage for household food security and commercial oriented systems a) Household food security technologies b) Off grid commercial oriented storage	a) Market ready and prototype ready b) Prototype ready Technologies piloted in Malawi, Uganda, Tanzania, Ghana	• Explore: the type of storage techniques which are best suited for households by gender, location, culture/socio-economic status and agro-ecological zone. • The type of off-the grid technology best suited in different locations by user • Cost effectiveness and Cost Benefit Analysis for smallholder farmers and traders
Sweetpotato silage	a) Market ready for pigs b) Proto-type for other livestock like cattle	• Reformulate sweetpotato silage for profitability and nutritional outcomes (for pigs) • Test sweetpotato silage based diet options for other livestock
RTB Silage	Proto-type innovations	• Explore the appropriate proportions of cassava, banana and potato residues which can be combined with sweetpotato residues for livestock feeds
SP puree technology	Market ready	• Evaluate sweetpotato varieties to identify those that are best suited for puree production by location and user • Test and validate complimentary nutritious foods that can be developed from sweetpotato puree • Test models for economic viability of the puree technologies by location and user

Questions and Discussions

- Does sweetpotato silage innovations have a negative impact on food security?
    - Sweet potato silage utilizes vines and not roots with roots constituting only 6% and these are usually uncommercial roots.
- 3 models for adopting this technology have been identified;
    - farmers preparing their own silage,
    - Youth group with portable chopper who chop at a fee
    - Entrepreneurs preparing their own silage and also selling to other farmers.
- A number of hurdles were identified especially, the high cost of choppers, unavailability of choppers with appropriate power and limited time and resources to operationalize the business plans.

- Collaboration with government agencies on quality should be established - process is ongoing but the innovation has not yet been submitted to Uganda National Bureau because it has not yet reached the stage of product testing.
- Further research to be conducted on the use of peels for food products

2.3.4 RTB-ENDURE Cassava subproject

Presented by Kelly Wanda, IITA (s/qmj94cd9ynlurxx)

Extending the shelf life of fresh cassava roots (FCR) for increased incomes and postharvest loss reduction:.

Key research findings:

- Pruning combined with relative humidity storage (RHS) increases the storability of FCR up to 2 weeks
- Pruning combined with waxing increases storability of FCR up to 30 days
- Pruning does not affect dry matter, starch cyanide but increases reducing sugars
- Shelf-life extension maintains eating quality of FCR (sensory evaluation). Waxed roots ranked highest, followed by RHS
- Technology is acceptable to both women and men farmers, traders and consumers.
- Consumers willing to pay premium price (UGX 2,000 - 3000 per kg-waxed; 1,629 per kg-RH vs 800 per kg-conventional roots)
- Demanded by all niche and mass markets
- NPV positive USD 4,501.54 (farmers); 5,543.03 (trader)

Key Research Outcomes

- Increased sales by pilot pack houses
- Increased incomes by 100 % for the cooperative that implemented the innovations
- Increasing demand for waxed roots
- Increasing number of beneficiaries from 100 in year one to 500 in year two; 70% women
- Increased investments in production of suitable cassava varieties
- Enhanced networking (actors, private public and reach)
- Initial adoption of selling by weight system
- Increased demand of market preferred varieties
- 3 supermarkets, 5 restaurants being supplied with extended shelf-life cassava roots

Next Steps

Technology	Stage in Innovation Trajectory	Next Steps
Agronomy		
Ridging	Prototype • Reduces harvest losses • Increases root yield	1. Impact of ridging on rood yields and shape 2. Cost Benefit Analysis 3. Capacity building for users

Planting technique Horizontal: longer peduncle Vertical: shorter peduncle	Prototype • Technology has been demonstrated at one site, but data was not quantified	1. Effect of horizontal vs vertical planting on the length of pedoncles in three different agroecological zones 2. Longer peduncles reduce root injury during harvest, and therefore contribute to PPD reduction and are needed for waxing. 3. Cost/Benefit analysis 4. Capacity building and dissemination for users
Pruning	Technology ready	1. Optimization for different varieties in terms of biochemical composition, shape of plant 2. Consumer profiling and evaluation by segment and rural and urban locations 3. Capacity building and dissemination
Shelf-life extension		
Waxing	Technology ready	1. Optimization of harvest time by variety 2. Effect of waxing and RH on enzyme activity and scopoletin 3. Sensory analysis of waxed roots
RT Storage	Prototype	1. More evaluation of alternative storage packaging: (type and size of bags). 2. More analysis of biochemical and physiological effects of RH on cassava roots 3. Piloting / trials in three different agro-ecological locations. 4.

Plenary Discussion

During the plenary discussion, it was revealed that a bio-chemical analysis was done to test impact of pruning but observed that there was need to do more research. It was also learnt that when pruning is done, starch is converted into sugar. It was also agreed that there is need to determine the percentage changes in sugars and comparing the different varieties.

2.4 LESSONS LEARNT FROM RTB ENDURE

Presented by Diego Naziri, CIP (s/f5x4pq5qkrte4bm)

Diego Naziri noted that action research and learning approach was based on 3 main pillars (Research, Value Chain Development (VCD) and Capacity building). Sub-project multi-disciplinary teams (technology, economics and other social sciences) were important and there was also strong emphasis on multi-stakeholder partnerships and private sector. This approach

promoted technology adaptation (feedback), identification of new knowledge gaps/researchable issues and early adoption. Other key lessons were that:

- The balance between research, value chain development and capacity building depends on where we are along the impact pathway (no "one size fits it all" solution).
- PMCA is a useful tool for creating joint vision, trust and partnerships, but requires adaptation for medium-large scale projects.
- It is important to engage the private sector at the right time when there is something to offer otherwise they lose interest.
- Cross-crop, cross-center collaboration is possible but challenging. Need to share methods and tools, opportunities of cross learning and ideally multi-crop research.
- Scoping studies useful to collect key initial information and guide intervention design but it is time consuming and increases overall project costs.
- There were mixed feelings about the initial competitive approach.
- Adaptive management and donor flexibility was critical in facilitating appropriate response to opportunities and challenge of scoping studies and during implementation.
- It is important to allocate adequate resources to gender responsive and communication.

Comments and Discussions

- Youth have to be categorized for business models plans so that they are effectively targeted since the needs are different for each category
- In the future, capacities of the partners in the project should be built
- For easy collaboration, common areas of research and activities have to be chosen
- A scientist with strong skill set has to be chosen to backstop the process in any given location to be able to provide solution to challenges in the locations when they came up

2.5 Reflections On Endure Achievements: Sweet Spots, Open Questions and Blind Spots

Presented by Dietmar Stoian, Bioversity

Dietmar Stoian's presentation was based on inputs derived from group work during the RTB-ENDURE stakeholders' meeting.

Sweet spots

1. Value of institutional collaboration framework
2. Market driven approach
3. Hand-on approach to solve problems in value chains
4. Market diversity- domestic and cross-border market
5. Gender focus to empower women

Open Questions

1. Systematic capture of statistics

2. Link between gender and livelihood adaptations
3. Comparative analyses: cross-case + cross-country
4. Skills set needs for scaling

Blind spots/limitations

1. Time was limited.
2. No clear exit strategy
3. Market focus at the beginning, but not throughout
4. Value addition: more needed

Synthesis

1. Lack of time was cause of most blind spots
2. Donor pressure to achieve quick results was also a challenge
3. Market oriented approach appreciated, with opportunities for strengthening certain aspects [business plan implementation, investment].

2.6 THEMES, IDEAS AND INNOVATIONS IN RTB

Presented by Keith Tomlins & Ben Bennett, NRI (s/c3ilzjtb5608xs5)

Keith Tomlins and Ben Bennett of Natural Resource Institute (NRI), University of Greenwich made a joint presentation on current advances in RTB postharvest Innovations focusing on target beneficiaries, commodity coverage, possible themes, areas of innovations and outcomes. It was noted that in dealing with RTB innovations, it was important to deal with environmental waste from RTB processing and addressing labour displacement in postharvest RTB Sector focusing on the need to think of unintended consequences of our innovations.

Target beneficiaries

1. Small scale subsistence farmers
2. Small holder farmers with potential for market access
3. Emerging commercial farmers
4. Women and youth
5. Small, medium and (large) scale processors and their employees.
6. Fabricators for equipment (not really beneficiaries but important to make efficient technologies available to the beneficiaries).
7. Value chain actors that improve efficiency. There is much thought on what is going on.
8. Consumers/ end-users – need more integration and work on consumer acceptance.

Commodity coverage

Commodity	Status	Main form at first point of sale	Processing	Suggested priority
Cassava	Food security Industrial input	Fresh	Some sold fresh. Many processing options.	*****
Yam	Food security	Fresh	Some processing	***
Potato	Food security	Fresh	Some processing	***
Sweet potato	Food security	Fresh	Some processing	*****
Banana	Food security	Fresh	Some processing	****
Plantain	Food security	Fresh	Some processing	****

Successful recent postharvest innovations in RTB

1. Starch production in cassava
2. High quality cassava flour
3. Curing of cassava
4. Pro-vitamin A sweet potato [cassava] puree
5. Cassava chips for biofuel and bioethanol
6. Potatoes-sprout control by ethlylene
7. Cassava beer
8. Gluten free sector
9. Starch based plastics
10. Sprout control of yams + curing + low cost stores
11. Gains from losses (Gratitude project)
12. Banana value end

Possible themes and areas on innovation-framework

- Postharvest innovations to ensure RTB crops contribute to Small holder food and nutrition resilience
- Innovations in root/produce storage, handling and marketing
- Ensuring produce characteristics meet consumer and end-user characteristics
- Value chain innovations for traditional crop products
- Collaboration with food industry to bring nutritionally-enhanced crops to urban markets
- Value chain innovations for commercial cassava products where farmers can supply

2.7 OPTIMIZING RTB BUSINESS MODELS

Presented by Ben Bennett, NRI (s/c3ilzjtb5608xs5)

Professor Bennet opined that many different scales and models of RTB enterprise were possible ranging from sole ownership to community development. He noted that RTB processing

businesses were not managed efficiently or operating optimally. Therefore, more sub-sector targeting was needed to link sources of demand and supply and there are great opportunities for benchmarking and promoting best practices. To optimize the RTB business models, there is need to take advantage of potentially transformative new web based solutions and internet.

Conclusions

Innovations	**Outcomes**
Improved on-farm, intra-household foods and enterprises.	Resilience and food security
Better policy improved nutrition, shelf-life/storage improvement	Compliance in an equitable competitive space Improved health Increased options, reduced risk, reduced losses
Consumer and market driven research	Alignment of innovations with sources of demand: push vs pull balance
Traditional products bre-engineered for new markets	

Plenary Discussion

During plenary discussion, a number of observations were made regarding how best to optimize the opportunities in RTB innovations and create substantial impact:

- There is a need to better understand the youth and make sure they are integrated effectively by crop and center research groups. We heard that in Nigeria the farming population is getting old which increases the need to bring the youth on board.
- There is a need for market responsive research to remain afloat. Nigeria used to pride itself in aroma of cocoa beans but this has become outdated due to many industrial players manufacturers various flavors.
- The new business models need to devise means of push for contract farming. While contract farming has had many challenges, it remains the most widely used model for creating impact to smallholder farmers.
- Purposeful breeding geared toward end user preferences is needed to make sure that products are favourable in the market
- Most agribusinesses are poorly run Therefore, there is need to work with entrepreneurs to translate innovations and ensure that such innovations succeed in the market.
- There are few private companies investing in RTB research so the sector will highly depend on public research.
- Cassava is the crop that has potential for processing in developing countries.

- What is the integration state of OFSP in the market?
- There should be technology innovation pipelines for the industry.
- The uptake of *gari* is not well coordinated.
- Most of the SMEs do not know where to go for new products as they are producers and not research
- The dissemination model where a centre of excellence is setup does not always work so need other options

2.8 GROUP WORK - RTB INNOVATIONS : ON-GOING AND MISSING

Participants worked in four small breakout sessions to collectively assess what is being done in postharvest innovation and what is missing. The discussion for the groups were based on the following themes:

1. Group One: Consumer profiles and quality characterization of RTB's for targeting end-user preferences.
2. Group two: Product development, improved processing, and nutrition interventions of bananas, potato, and yam.
3. Group three: Post-Harvest technologies and management option for RTB postharvest loss reduction and value-addition to waste products.
4. Group Four: Inventory and Information dissemination platforms for RTB postharvest technologies.

At the end of the session, "table masters" provided feedback at a plenary as presented below.

Working Group 1: Consumer profiles and quality characterization of RTBs for targeting end-user preferences

Ongoing work	Missing	
- Consumer profile and preferences for cassava-maize *Ugali* in Tanzania. Same study in central and northern Nigeria - High quality cassava flour in Uganda - OSP flour in Uganda - Processing HQCF [Chips] for confectionary/biscuits for mass market in Uganda - Promotion of native potato varieties to supply processing companies - Consumer surveys of different sweet potato varieties - Consumer survey of different sweet potato based processed products - Some systematic sensory evaluation - General market profiles in countries - HQCF cassava flour for bakery needed in biscuit industries [Nigeria] - Instant *fufu* flour- SME all over - Sensory acceptability of custard from yellow fleshed cassava root	- How preferences of RTB has changes - How preference of RTB related to non-RTB staples [maize, wheat, rice etc] - Gender differentiated consumer preferences and how they affect uptake of technologies - Quality assurance for OSP in Uganda - Appropriate packing and packaging materials for RTBs - Determination of nutritional value of processed products - Research on best practices – quality standards. - Quality standards for peeled bananas [Uganda]. - List of recipes to aid promotion [cassava flour in Nigeria] - Scaling up the SPS into the industrial level - SPS: Quality of the animal feed [Uganda] - Quality standards for cassava flour [Nigeria] - Consumer acceptability for biofortified cassava gari in Benin - Value chain and market studies including consumer preferences in Benin and Nigeria - Willingness to pay/case studies for peeled/packaged banana [Uganda] - Gender studies and willingness to pay by consumers of packed *gari*,	- Consumer perception of non-OFSP [sweet potato] based products. - Quality in terms of nutrition of SP based products deepening in deferent varieties. - Drivers of preferences - Diet transition - Feeding choices - Impact of processing on sensory characteristics [taste, texture etc] - Standard sensory profile methods - Prioritize crop profiles in each country/region - High thought out screening methods for breeders to select better varieties for end-users - Effectiveness of consumer education- value of nutrition information campaign

[Nigeria] - Pig production from SP vine types for silage use - Peeled banana in plastic bags- Urban consumers at open markets - Cassava into *gari* . - Using plastic packaging - CMS for cassava partly done in 2016 for the different foods. - Porridge on basis of beer banana types + millet: nutritious value and opportunities for industrialization.	market to youth. - Business models for supply of raw materials to cassava flour [Nigeria]. - Characterization of other RTBs apart from cassava on consumer preferences or quality traits in SS Africa. - Branding/ promotion - Feeding choices- changes in selection of infant foods and feeding practices. - Energy for processing	- Systematic approach to link more nutritious potato with public health and education program - Potential for substituting cereal products such as pasta with lower cost RTB flour for Africa [land locked mkts]. - Replacement of corn starch with cassava starch for custard and salad cream production [Nigeria] - Market acceptability of salad cream from cassava [Nigeria] - End user preference by gender and size - Proper characterization of market potential for bio-fortified RTB crops. - Market studies to banana based beverages potential in EA markets and beyond

Working group 2: Product development, improved processing, and nutrition interventions of bananas, potato, and yam

Ongoing work	Missing	
Product Development and Processing - Yam frozen food product (fries), export markets Nigeria - Salad cream from Yam starch IITA Nigeria - Pounded Yam (mechanized) (West Africa) - High Quality Yam flour for baking and *amala* (West Africa) - Innovative Yam recipes (Boiled yam, fried egg coated) (name?) - Yam (red) flour as thickener in food processing - Yam flour for ice cream - Banana flour (green banana) - Gluten free pasta (banana flour with legume) - Banana juice (concentrate and flavored) - Alcoholic beverages - Banana bread **Nutrition Intervention** - Characterization of the roots for nutritional quality (Yam, banana) - Vitamin C retention - Iron and zinc biofortification of potato	**Product Development and Processing** - Puree processing for yam - Preventing oxidation during processing of some yam varieties - Shelf-life extension of fresh yam - Preventing sprouting in yam - Commercialization up-market products - Harvesting of bananas - Physiochemical characterization of raw materials affecting the sensory and consumer acceptability of raw materials - How raw material components interact with each other during processing (Yam and banana) - Packaging solutions (transport and consumer) - Large scale drivers of demand for RTB - Better peeling technologies - Long shelf-life - Target industries for update	**Nutrition Intervention** - Mass distribution of biofortified crops - GMO deregulation and commercialization and Regulations for biosafety of GMO - Willingness to pay for GMO and Biofortified (banana, potato) - Biofortification for yam - Promotion of biofortification and strong advocacy - Awareness and acceptability of new product - Knowledge of anti-nutritional factors Potato, Yam and Banana - Linkages between technologies and policy movements in the countries - Proximate analysis of the crops - Bioavailability studies for nutrients in Yam, Banana and potato - Nutritious foods for school programs to fight malnutrition - Glycemic index of the Potato, Yam, Banana and derived processed product - Harmful effects of

Ongoing work	Missing	
- Proximate analysis of potato - Food to food fortification (RTB-yam and soy bean, cow peas, fish) - Food basket approach - Effect of processing on the nutrient		processing on Yam, Banana and Potato (food safety, oil) - What drive uptake of processed products - Linkages with private sector for update of biofortified potato for schools children - Nutritional cost of post-harvest losses

Working group 3: Post-Harvest technologies and management option for RTB postharvest loss reduction and value-addition to waste products

Ongoing work	Missing	
	Post-Harvest Losses	**Residues**
- Peeling technology - Cassava peels for feed (IITA-ILRI). - Use of biomass for drying - Biofuel using residues - Peels for mushroom - Sprout control - Platforms/ICT to coordinate supply chain and losses, transaction costs - Off-grid storage (solar, charcoal) – Sweet potato, potato, banana, yams - Cold storage – potato, banana, sweet potato, cassava - Packing technology - Harvesting technology - Sweet potato puree - Solar drier hybrid - Mechanical harvesting - Product development – cassava - Unripe banana with higher nutrient value	- ICT for coordination chain - Research on best harvesting time (banana, cassava, yams, potatoes) - Semi – processed product (Puree, HQCF) - New markets with fermented food (beverage) – to Grp 2 - PHL assessment - Innovations to add value to small potatoes left in the field (relevant for cassava and sweetpotato RTB) - Harvesting technology - Promotion of improved packaging (Crates) - Puree for other RTBs - Sprout control (Yam) - Cost Benefit Analysis of technology - Off-grid and cold storage (incl. alternative energy sources) - Technology for shelf-life extension of peeled/unpeeled banana (APEEL) - Different types of bags (shelf life) - Low cost curing - Sensor for measuring temperature and humidity	- Additional research on use of biomass for drying - RTB waste for mushroom - Nutritional value yam peels/safety - Better understanding of composting of residues - Proportion of use of residues for biogas and feed - Use of RTB residues for insect breeding for fish feed - Use of residues for enzyme production (analysis from cassava peels) - Silage on livestock - Composite silage (and RTB residues) - Industrial alcohol from RTB incl. residues (peak supply time) - Research on peeling technology

Working group 4: Inventory and Information dissemination platforms for RTB postharvest technologies

On-going work	Missing
- Inventory of Farmer associations, National and regional stakeholder platforms and CGIAR Site integration - IFAD - Cassava Technology - Many existing inventories – quickly are out of date - ICT (internet, radio) use for linkages between cassava value chain actors - Existing innovation platforms in East Africa on cassava value chain - Online network with different institutions about cassava processing in Benin (universities. IITA-Benin) - Crop – specific platforms are available and operational in Uganda especially for banana & potatoes - Engagement of stakeholders in project development and implementation especially in project sites - Stakeholder engagement to provide information on innovations - Trade fairs/exhibitions and product demonstration - Dissemination of findings to farmers and beneficiaries - Incorporation of various market actors in scaling up projects as well as proof of concept projects for ease of technologies adoption - Reports & peer reviewed papers published in open access journals - Creation of communities of practice particularly in sweet potato - "Value chain hub" for knowledge sharing and learning on methods and tools and impact assessment (in collaboration with PIM) - Multi-stakeholder platforms for sweet potato, banana, cassava and pigs at national & regional level	- Platforms and associations - Printed materials, posters and technical guidelines - Partners duplicating technologies - Technical equipment benchmarking - Need to test all the equipment - Curricula of agriculture colleges on post-harvest - Regional cross-fertilization of tech + training materials in difficult language - National Post-Harvest innovation platforms in target countries - Dynamic information on post-harvest technology - Aggressive engagement with national institutions with the responsibility of post-harvest technologies - Involving national institutions in field testing of innovations. - Budgeting and making funds available in proposals for dissemination of innovations. - Mass media engagement to disseminate innovations. - Linking the platforms with end-users on innovations already developed especially for banana for quick uptake - Share findings with industries e.g feed industries - Establish the innovation platforms [IPs] which allows to link actors of cassava to input and output markets and information [Benin] - Gender responsiveness in information dissemination

On-going work	Missing
- Information & technology dissemination through NGOs & public institutions - Multi – sector/Stakeholder cassava platforms set up - ICTs – WhatsApp group - Scientific workshops/conferences/publications/platforms - Manuals and guidelines for field workers/next users	- Community of practice across the RTB crops for cross learning - Common repository of knowledge products of technologies produced through commodity based to other RTB crops - There is little structured efforts to ensure that technologies are adopted or inform policy makers. - Dissemination through ICT [phones etc] - Organized collaboration between research and dissemination channels. - No particular platforms on post-harvest especially for sweet-potatoes [Uganda] - Links with private sector for technology dissemination aimed at reducing PHL - Decision making tools for entrepreneurs to choose processing technology, equipment available, promotion and profitability.

3. PROCEEDINGS OF WORKSHOP DAY TWO

Day two of the workshop opened with a recap by Fred Grant who highlighted the key messages from day one. The day then proceeded with participants brainstorming on mechanisms of how CoA 4.1 links with other clusters within FP4, FP2, FP3 and FP5.

3.1 POSSIBLE LINKAGES WITH OTHER CLUSTERS IN FP4, FP2 AND FP5

Thierry Tran moderated this brainstorming session**.** Participants advanced numerous possible linkages with other Clusters as presented below:

- CoA 4.1 is a learning platform for other clusters.
- There are strong interactions between Cluster CC 4.1 and Cluster CA 4.2. There is need to learn more from cassava experience since cassava processing at small scale is more developed compared to other RTB crops.
- CoA 4.1 can contribute to FP2 in terms of developing methodologies.
- Strong linkages between 4.4 and 4.1 due to the need for technology to address loss of nutrients
- There is limited linkage between CC4.1 and 4.3, especially with technology for retention of carotenoids.
- Cost Benefit Analysis needed for linkages between FP4 and FP2
- Sensory profiling to feedback to FP2
- How product varieties and crop management influence product quality
- Classify the gaps identified (FP4 and FP5) and how to fill them
- Identify how interventions in FP4 can lead to improved livelihoods which is FP5
- Need for breeding varieties that have appropriate processing traits and need to improve varieties for processing
- FP5 (Cluster 5.3) works with FP4 regarding gender-differentiated consumer needs and FP2 on processing needs.
- Evaluating how post-harvest contribute to nutritional losses meaning CC4.1 will link with 4.3 and 4.4.
- Consider how to use pre-harvest deteriorated/pre-market roots e.g CBSD affected roots.
- Need for combined effort for common demand creation between CC4.1, 4.4 and other clusters
- Need to identify the linkages and see the mechanisms. We learnt from ENDURE that processing needs certain varieties.

- Breeders need to fast identify consumer attributes. Need to engage the consumer in the process of developing a variety. So, the different flagships can help each other as information from consumer preferences will feedback to the breeding programs.
- Technologies to reduce PHL. How to adapt it to different crops
- Develop crops that are suitable for market needs e.g suitability for mechanical peeling
- The record on the adoption of CG varieties is poor. What is the linkage between our research work, extension and market e.g some varieties have a huge yielding gap. As we do product development, there is need to talk with users either farmers or processors.
- End-user traits should be measurable; need for quantification of sensory qualities; handling qualities and processing qualities.
- Need to make sure there is empowerment of women and youth to ensure impact.
- Need to asses any possibility of cross-crop product development, e.g flours and juices.
- CC4.1 and 5.1 can work together by developing tools to predict future demand in CC4.1 at scale, link 5.1 to study adoption and impacts.
- CC 4.1 and CC 2.1 need to link in order to increase dissemination.
- FP5 and CC4.1 can link to collaborate in developing methods for gender responsive technologies. Also need to look at consumer preference studies and need to look and gender segregated preferences in 5.3.
- Considering RTBs as shopping malls, there is need to increase communication about our products through dialogues and this need to start with demand side which is FP5.
- Need to look at the perspective of the farmer. Have the challenge of negative perceptions about our roots and tubers changed and how to make commercially viable. Need to emphasize social research aspects.
- Need for concerted efforts to disseminate outputs, products.
- There is need for a mechanism to inform research agenda of FP2 and FP3 by creating demand and supply of research knowledge.
- FP5 informs our dissemination agenda.
- There is need for resources to facilitate collaboration between flagships and breeders. Postharvest scientists need to work with breeders but there is lack of resources.
- The breeding process has been targeting constraints like drought, disease but with limited effort on post-harvest handling. Need to ensure end-user quality traits are being incorporated in the breeding process. Interpersonal relationships are also key.
- Cost Benefit analyses for RTB processing equipment/machine.

Comments and Discussions

The "how" question was not adequately answered in the brainstorming session, but this was very critical to operationalizing the linkages.

3.2 RESEARCH CLUSTER CC4.1 IMPLEMENTATION PLAN AND RESOURCE MOBILIZATION STRATEGY

Presented by Simon Heck, CIP (xxx)
Simon Heck presented the current implementation strategy and existing funding widows and facilitated a plenary discussion on possible sources of funding and resource mobilization strategies. He explained that RTB phase II covers 2017-2022 and there are three implementation pathways:

A. Ongoing and future projects by individual CG centers and collaborations.
B. RTB centrally funded activities ("earmarked funds")
C. New projects developed, fund-raised and implemented by the Cluster team

A. Ongoing activities by individual CG centers and collaborations

It was noted that ongoing activities by CG centers and collaborators are funded through a full range of W1/2, W3, and bilateral funds and more than 30 deliverables are already committed for 2017.

Cluster	Activity/ Product	Activity/ Product Leader	Output	Category	Deliverable	Type	Reporting Scientist	Center	Delivery Date
RTB-CC4.1 - Postharvest innovation & nutrition improvement	RTB-CC4.1.1 - Consumer profiles and quality characterization of RTB's for targeting end-user preferences	Bussie Maziya-dixon	RTB-CC4.1.1.1 - Instant pounded yam-fufu flour using existing and new yam varieties developed and tested in Nigeria	Data	9066 - Varieties suitable for pounded yam fufu and instant pounded yam fufu flour production	Internal Document	Bussie Maziya-dixon	International Institute of Tropical Agriculture - IITA	2017

B. RTB centrally funded activities

This type of funding has been named Earmarked funding where scientists present proposals under three windows and approved for funding. The three funding windows are:

I. Type 1: Start-up funding for clusters that need to better shape the vision, set-up the portfolio, bring the team together and develop a resource mobilization strategy. Funding level is up to $200,000

II. Type 2: Cross-cutting and cross-center cluster funding between $ 400,000- $800,000 on a yearly basis for 2017-2019. Level per cluster will be defined before clusters are invited for "fund request-submission".

III. Type 3: Thematic areas that are crosscutting and spread over CC and crop specific clusters. Funding level is up to $400,000.

C. New projects developed, fund-raised and implemented by the Cluster team

A Cluster will be a platform for identifying and developing fundable projects focusing on multi-crop and cross-cutting challenges and opportunities based on ideas from the workshop and additional ideas and specific follow-on to ongoing or recent research ("low-hanging fruits"), where the Cluster team is best positioned.

3.3 POSSIBLE SOURCES OF NEW FUNDING

Through brainstorming, participants raised various possible ways of non-traditional funding:

- Rockefeller Foundation which is already funding some work on cassava in Nigeria and tomatoes in Kenya.
- MasterCard foundation: MasterCard is interested in job creation for youth, food availability and food processing.
- National partners e.g Governments because RTB are major crops for food security.
- Private sector [Multinational companies] can find ways of cross synergies.
- Africa Trust Fund which is looking at employment and food security.
- Impact Investors who invest money in value chains though may not be interested in research.
- The Netherland government which is currently funding IFDC. They are doing work that can fit in what the cluster is doing.
- Using link that are usually engaged in advertising call for proposals.
- It was suggested that there should be a resource mobilization office.

3.4 ACTIONS NEEDED FOR NEW FUNDING

To be able to attract funding through the proposed or possible funders and form new partnerships, the following actions were suggested:

- Complete mapping of deliverable of clusters

- Timely and quality reporting
- Include CC4.1 components in new projects
- Implement 2017 activities, submit deliverables on time
- Prepare request for 2018-19 [Type 2 or 3 to be confirmed].
- Identify potential funding sources
- Prepare funding proposals
- Need to bring in experts
- Mobilization of funds from the centers and centrally by Cluster Team Members should continue.
- Need to discuss why we need to remain loyal even when individual organisations get funds from other sources.
- Need to keep inter-partner relationships to ensure complementary skills sets as a prerequisite for winning proposals

3.5 Key Public and Private Sector Partners for Advancing Research Ideas in RTB Postharvest Innovation

Dietmar Stoian from Bioversity introduced this session, stressing the importance of distinguishing between research and development partners (government agencies, NGOs, private sector, media), accounting for their varying roles across the different stages of the impact pathways, and identifying appropriate mechanisms of enagagement for the different types of partners and scaling phases. Participants were then grouped based on the five RTB crops (banana, cassava, sweet potato, potato and yams) to discuss key public and private sector partners, their potential role in postharvest innovation and nutritious product implementation, and essential mechanisms for effective research collaboration for each of the crops.

Banana Group

Research and Development Partners	Technology Development	Initial Scaling	Massive Scaling
NARO	○ Resource mobilization ○ Research mobilization-facilities, mandate and expertise	○ Pilot testing and refinement	○ Extension ○ Dissemination
CGIAR Centers (Bioversity, IITA)	○ Collaborative research ○ Resource mobilization ○ Linkages to other partners	○ Pilot ○ Testing ○ Refinement of	○

		technologies	
UNIDO-Uganda Industrial Research Institute	○ Focus of quality standards ○ Resources	○ Pilot testing	○
Universities e.g. Makerere University	○ Student involvement in Research ○ Facilities ○ Expertise ○ Joint Resource Mobilisation ○ Multiplication ○ Bulking	○ Pilot testing ○ Technology refinement ○ Dissemination	○ Dissemination
Industrial processors (Afribanana, Jakana).	○ Research collaboration ○ Facilities	○ Initial testing	○ Technology development
Uganda National Bureau of Standards	○ Quality control	○ Quality control	○ Technology transfer
NARs-Nigeria	○ Limited knowledge on this because the group had only Uganda members	○	○ Dissemination
Banana Platforms	○ Funding ○ Marketing	○ Funding ○ Marketing	○ Engaging with media
Private business enterprises	○	○ Funding	○ Project based funding
Extension	○	○ Expertise	○ Scaling
Media centres-Radio West, CBS etc.	○	○	○ Dissemination ○ Advertisement both in print and press

Sweet Potato Group

Partners and mechanisms	Technology Development	Initial Scaling	Massive Scaling
Partners	○ NARO- Uganda ○ Makarere University ○ Private sector- processors, aggregators, traders ○ Uganda Industrial Research Institute	○ NARO ○ Makerere University Food Science innovation Center ○ UIRI ○ Private sector ○ Supermarkets	○ NGOs ○ NARO ○ Farmers ○ Financial Institutions ○ WFP
Mechanisms of Engagement	○ Scoping study	○ Lesson sharing and learning ○ Partnership ○ Monitoring and Evaluation activities	○ Monitoring and Evaluation activities ○ Advocacy ○ School feeding programs

Potato Group

Partners and mechanisms	Technology Development	Initial Scaling	Massive Scaling
Research and development partners	○ IFDC ○ NARS ○ CABI ○ Universities ○ Harvestplus ○ Irish Aid ○ European Union ○ USAID ○ BTC ○ INIA-Ecuador/Peru	○ IFDC ○ NARS ○ Kisima Farm - kenya ○ Suera Farm- Kenya ○ Agriseed- Rwanda ○ Potato Farmer Association ○ Potato Council of Kenya ○ National potato Platform-Uganda ○ Financial Institutions ○ Self-Help Africa ○ FAO ○ Agra ○ Irish Aid ○ Mercy Corps ○ USAID ○ BTC ○ GIZ ○ Mc Night Foundation ○ INIA- Ecuador ○ World Vision ○ Iceman Company ○ Pepsi	○ National Extension Services ○ IFAD ○ One Acre Fund ○ Potato Platform ○ IICA ○ Shoulder to Shoulder program ○ School feeding programs ○ Health ministry ○ Education ministry ○ IFDD Investment project
Mechanisms of Engagement	○ Research projects ○ Tissue culture multiplication ○ Technology proof of concept ○ Bilateral projects ○ Co-investment	○ projects ○ Public private partnerships ○ Development projects ○ Constructing storage facilities ○ Multiplication of generations 2-3 ○ Technology proof of concept	○ Linkage with country strategy of World Food Program and Ministry of Agriculture, education and Health ○ Advocacy and policy dialogue

Cassava and Yam Group

Research Partner	Technology Development	Initial Scaling	Massive Scaling
Research Partners	○ NARS ○ Equipment manufacturers ○ Regional research programs –FARA, CORAF, ASARECA, ○ SMEs ○ Universities ○ Advanced Research Institutions (ARI) ○ Large Food and Non food industries	○ CSIR,NARO, NARLS ○ Universities ○ Equipment manufacturers ○ SMEs ○ Regional research programs ○ Food service industries ○ National Research Fund	○ Equipment manufacturers ○ Food and non-food industries ○ SMEs ○ Donors: IFAD, USAID, World Bank ○ National regulatory agencies ○ Extension services ○ Ministry of Agriculture
Mechanisms of Engagement	○ Stakeholder workshops ○ Joint project proposals ○ Interpretation of research ○ Resource mobilization ○ Planning workshops ○ Proposal writing ○ Implementation of research	○ Innovation platforms ○ Pilot testing ○ Consumer acceptability ○ Economic analyses ○ Developing financing mechanisms	○ Stakeholder engagements ○ Shows and exhibitions ○ Market linkages ○ Value chain specific media ○ Gender responsive research ○ Environmental compliance analysis

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4. ACTION POINTS AND CONCLUSIONS

Busie Maziya-Dixon facilitated this session which was a combination of plenary presentation and brainstorming. She said post-harvest innovations can make significant contributions to the global challenge of malnutrition. In addition, cross-center collaboration on post-harvest and nutrition issues has improved, notably within the framework of the ENDURE project and the development of the RTB Phase 2 proposal.

4.1 KEY ACTIVITIES FOR 2017 AND DELIVERABLES FOR EARMARKED FUNDS

Deliverables for Earmarked Funds

Deliverable	**Type**	**Description**	**Expected delivery date**
Lessons learned and way forward for RTB post-harvest innovations	Report	Summarizes the lessons learned and priorities for follow-up activities emerging from the ENDURE stakeholder workshop	Q2/2017
Strategy document for CC4.1	Strategy	Lays out principal topics, potential funding sources, budget targets for 2017-2019, and roles and responsibilities of each participating center, forms and mechanisms for internal communication, monitoring and joint learning, as well as roles and responsibilities of each participating center	Q3/2017
Stakeholder priorities for post-harvest innovations in selected target countries (Uganda, Nigeria Peru and Vietnam)	Report	Lays out priorities of stakeholders in principal RTB value chains in Uganda, Nigeria, Peru and Vietnam with respect to post-harvest innovations The purpose of the workshop will be: - Identifying and discussing demand for postharvest research in each target country - Creating buy-in across sectors (public and private sectors and civil society). - Generating ideas for developing joint proposals.	Q4/2017
Post-harvest innovation proposals	Proposals	Two crop and center cross-cutting proposals	Q4/2017

Ways of operationalizing the Work plan

1. Use of social media platforms especially Facebook
2. Global mailing list
3. In-country teams should have a directory
4. Using the CGIAR page
5. Use basecamp: project management and team communications software

Code of Conduct

Participants suggested a code of conduct for members to follow in order to create harmony and meet the cluster objectives. A code of conduct was needed because the team comprises of people from different organizations, different countries and different cultures. Some of the suggested conduct are

- Mutual respect
- Transparency
- Professionalism
- Commitment
- Honesty

Members be champions within their respective centers.

4.2 CLOSING SESSION

Dietmar Stoian thanked all the participants for putting in all their efforts. He noted that this was very important in ensuring positive transformation from ENDURE to CoA 4.1. Ben Bennett and Keith Tomlins were specially recognized for having spared their valuable time to be part of the workshop and for the rich contributions they made. It was noted that the outcome of the workshop was very satisfying as it had raised key inputs to inform the development of a thoughtful strategy.

Simon Heck, the FP4 leader encouraged the team to remain professional in order to be able to acquire the resources needed to actualize the work the cluster is capable of doing. He also thanked the government of Uganda for hosting the partner research organisations in the country.

A vote of thanks was given by Busie Maziya-Dixon, the CoA 4.1 Cluster leader who repeated the importance of cross-centre collaboration for the success of the cluster. This was demonstrated by IITA working with the CIP support staff to successfully organize this workshop.

Plan of action -12 June to 31 Dec. 2017

Action	Timeline	Responsible
1. Write and circulate workshop reports	June/July 2017	CIP-Sarah
2. Create awareness among key stakeholders in target countries	June-October 2017	IITA-Busie
3. Conduct Cross-cutting consultation/stakeholder workshop	October 2017	Uganda-Enoch and Sarah
4. Develop a Strategy document for CC4.1	By end of 2017	Nigeria-Busie and Adeyinka
5. Develop postharvest innovation proposals	By end of 2017	Peru-Claudio and colleagues

5. PARTICIPANTS

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