



# RTB Workshop Report

**Priorities for RTB Post-Harvest Innovations** 

**Fairway Hotel, Kampala Uganda**

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16-17 O C T O B E R 2 0 1 7



RESEARCH  
PROGRAM ON  
Roots, Tubers  
and Bananas





## **RTB Workshop Report**

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# Executive Summary

The stakeholder workshop organized under the theme “Priorities for RTB post-harvest innovations”, held in Kampala on October 16-17, 2017, was hinged on three key objectives: 1) sharing the current research portfolio on post-harvest innovations and findings of previous meetings on researchable issues that cut across Roots, Tubers and Bananas and centers; 2) identifying research priorities of stakeholders from Uganda, Nigeria, Vietnam and Peru with regard to post-harvest innovations in RTB crops; and 3) determining key elements of post-harvest innovation proposals for the target countries. The 45 workshop participants included 19 stakeholders from research organizations, academia, private sector (processors), policy makers and farmers' cooperatives, along with 36 researchers from CGIAR centers (Bioversity, CIAT, CIP, IITA) and CIRAD.

The key elements identified for funding proposals were centered around four sub-themes: 1) Consumer profiles and quality characterization of RTB for targeting end-user preferences; 2) Product development, improved processing, and nutrition interventions of bananas, potato, and yam; 3) Post-harvest technologies and management options for RTB post-harvest loss reduction and value-addition to waste products; 4) Inventory and information dissemination platforms for RTB post-harvest technologies.

Areas for important synergies across the priorities identified include:

- consumer profiling and quality evaluation
- extending the shelf-life of RTB crops for food and non-food sources
- product development to expand utilization and incomes
- residue/waste management for animal feed and other uses
- broadening/intensifying utilization of RTB crops.

The roles of the stakeholders in proposal development were identified and the weaknesses in the human resources available (in-house capacity) were highlighted. Furthermore, suggestions were made of potential partners with the required expertise who could be brought on board for collaboration soon.

# Acronyms

CIAT	International Centre for Tropical Agriculture
CIP	International Potato Centre
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
FIIRO	Federal Institute of Industrial Research, Oshodi
FP4	Flagship 4
HQCF	High Quality Cassava Flour
IITA	International Institute of Tropical Agriculture
KYU	Kyambogo University
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MAK	Makerere University Kampala
NARL	National Agricultural Research Laboratories
NARO	National Agricultural Research Organization
NRCRI	National Root Crops Research Institute
OFSP	Orange Fleshed Sweet Potato
PIM	CGIAR Research Program on Policies, Institutions and Markets
PPD	Post-harvest Physiological Deterioration
RTB	CGIAR Research Program on Roots, Tubers and Bananas
SME	Small-Medium Enterprises
UCU	Uganda Christian University, Mukono
UIA	Uganda Investments Authority
UNBS	Uganda National Bureau of Standards
VC	Value Chain

# Acknowledgments

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# Priorities for RTB Post-Harvest Innovations

## Background

The second stakeholder consultation workshop in relation to the Cluster CC4.1 of the CGIAR Research Program (CRP) on Roots, Tubers and Bananas (RTB) entitled “Priorities for RTB post-harvest innovations”, held in Kampala, Uganda on 16-17 October 2017 brought together 45 participants from various research and development organizations across Africa, Asia, Latin America and Europe, including 19 stakeholders from Uganda, Nigeria and Vietnam. Participants represented RTB participating centers, namely Bioversity International, CIAT, CIP, CIRAD and IITA. Stakeholders represented strategic partner organizations, including, Banana Cooperative Union, *ExcelHort*, FIIRO, MAAIF, MAK, NARO, NRCRI, Uganda Christian University, UIA, UNBS, among others.

The workshop was structured around facilitated break-out groups, presentations and plenary discussions to allow all participants to engage in the discussion. Key insights were presented by Simon Heck, the flagship leader, who gave an overview of Flagship 4 ((Nutritious RTB foods and value added through post-harvest innovation); and Busie Maziya-Dixon, the cluster leader, who presented an overview of Cluster 4.1 (Demand-led approaches to drive post-harvest innovation and nutritious RTB products). Positive feedback was received from participants who saw clear prospects for cross-crop and cross-center collaboration, harnessing linkages between the clusters within flagship 4 and with those in other flagships, and bringing on board other strategic partners along the value chains. The next sections of the report provide an overview of the workshop sessions and results, including the objectives and the agenda of the workshop, a summary of the presentations and discussions, conclusions and suggestions for the way forward.

## Objectives

The workshop had the following objectives:

- 1) Share the current research portfolio on post-harvest innovations and the findings of previous meetings on researchable issues that cut across Roots, Tubers and Bananas (RTB) and centers
- 2) Identify research priorities of stakeholders from Uganda, Nigeria, Vietnam and Peru with regard to post-harvest innovations in RTB crops
- 3) Determine key elements of post-harvest innovation proposals for the target countries

## Agenda

The workshop agenda is presented in Appendix 1 and the list of participants in Appendix 2.

# Proceedings of workshop Day 1

The major activities on Day 1 (16 October 2017) included the introduction of the participants to CRP on RTB and sharing an overview of Flagship 4 and Cluster 4.1. Insights from the first strategy development workshop held in Entebbe (June 2017) were also shared, which highlighted advances made in post-harvest innovations, prevailing gaps and how such gaps can be filled.

The day started with self-introductions. Busie Muziya-Dixon, IITA senior scientist and cluster CC4.1 leader, gave a brief overview of the cluster. Welcome remarks were given by both Simon Heck (CIP) and Stephen K. Tumwesigye (NARO), who urged the participants to feel at home and enjoy their stay in Uganda. Dietmar Stoian (Bioversity international) gave an overview of the agenda and the purpose of the workshop. The principal goal for cluster CC4.1 for the year 2017 was highlighted, which hinges on the implementation strategy and resource mobilization.

## Overview of Flagship 4

### Nutritious RTB foods and value added through post-harvest innovation

*Presented by Simon Heck (CIP) [Day 1 - Session 1 Overview\RTB PH Innovations - FP 4.pptx](#)*

The leader of RTB Flagship four (FP4), Simon Heck, presented a general overview of the flagship. The general objective of the flagship is to support the full, equitable, and sustainable utilization of RTB crops for healthier diets and improved income opportunities. The flagship is based on two drivers: (1) the consumer is at the center of the research by addressing nutritional needs, diet preferences and gender aspects; and (2) the changing market demands with special focus on processing technologies, urbanization, environment and gender.

FP4 is composed of 4 clusters:

- I. CC4.1 Demand-led approaches to drive post-harvest innovation and nutritious RTB products (led by Busie Maziya-Dixon)
- II. CA4.2 Raising incomes and improving health and safety at small-medium cassava processing centres (led by Thierry Tran)
- III. CA4.3 Bio-fortified cassava varieties for improved nutrition and livelihoods (led by Elizabeth Parkes)
- IV. SW4.4 Nutritious sweet potato for expanding markets and healthier diets (led by Robert Ackatia-Armah)

The key achievements for each cluster in 2017 were also highlighted, especially those in relation to post-harvest innovations.

Cluster	Selected highlights: Post-harvest innovation
<b>CC4.1</b>	<p>Technologies verified for sweet potato-based silage, and cassava waxing:</p> <ol style="list-style-type: none"> <li>Reducing post-harvest losses through waxing of cassava roots in Uganda: <ul style="list-style-type: none"> <li>Technology adapted from Colombia</li> <li>Extends shelf-life from 3 up to 14 days (in combination with pruning)</li> <li>Initial uptake in supermarkets underway</li> </ul> </li> <li>Utilization of by-products and waste (improved sweet potato-based silage) <ul style="list-style-type: none"> <li>Bridges seasonal feed gaps; 40% lower costs than commercial feed</li> <li>Improved productivity of smallholder pig production</li> <li>Silage Business Centers (privately managed) – silage, equipment rental, training</li> <li>Pig production and marketing, promoting silage among its suppliers</li> </ul> </li> </ol>
<b>CA4.2</b>	<p>Cassava processing: influence of environmental factors on quality traits of cassava</p> <ul style="list-style-type: none"> <li>Environmental factors strongly influence quality traits (up to 400% variation)</li> <li>Evaluation of postharvest physiological deterioration (PPD), cyanide, dry matter</li> <li>Cooking (boiling) quality under evaluation</li> </ul>
<b>CA4.3</b>	<p>Comparative analysis of bio-fortified cassava and white varieties</p> <ol style="list-style-type: none"> <li>Comparing processing qualities of bio-fortified cassava varieties and white varieties <ul style="list-style-type: none"> <li>Significant differences observed between different cassava genotypes</li> <li>Bio-fortified varieties are competitive with conventional clones in proximate composition and peak viscosity</li> <li>Yellow HQCF is suitable for use in bread, other bakery products, and other food applications (thickener, stabilizer)</li> </ul> </li> <li>Nutritious snack food alternatives using high-quality flour of bio-fortified cassava with soybean and cowpea strips <ul style="list-style-type: none"> <li>Sensory evaluation of three products in Nigeria and DRC: Consumer preferences differ greatly</li> <li>Versatility of yellow HQCF as an ingredient</li> <li>Commercial partner NIJI LUKAS (Nigeria)</li> </ul> </li> </ol>
<b>SW4.4</b>	<p><b>Consumer studies and value chain of purée of bio-fortified sweet potato</b></p> <ol style="list-style-type: none"> <li>Longitudinal study on maternal health outcomes (Kenya) <ul style="list-style-type: none"> <li>Continued higher Vitamin A intake and better Vitamin A status of women who participated in agriculture-nutrition interventions at antenatal stage</li> </ul> </li> <li>Effect of nutrition information on consumer sensory experiences and evaluations (Kenya) <ul style="list-style-type: none"> <li>Information on nutrition benefits have little influence on sensory experience and evaluation</li> <li>‘Emotional profiling’ (EmoSemio) predicts preferences and adoption better than sensory evaluation metrics</li> <li>Important to combine information with demonstrations</li> </ul> </li> </ol>

The FP4 leader concluded his presentation with a summary of the possible opportunities and challenges going forward:

- i. Collaboration
  - Link with breeding work under flagship 2
  - Good collaboration on recent CIRAD-led RTB FOODS proposal
  - Good practice breeding-postharvest collaboration with crop programs
  - Collaboration with flagship 5
  - Three concept notes short-listed for the Scaling Fund (2 cassava and 1 sweet potato)
  - “Food safety in RTB value chains” training (Early 2018), organized by CIP, NRI, BecA, and University of Queensland
- ii. Funding support for post-harvest innovations
  - Regional investments:
    - AGRA
    - AfDB/TAAT
    - IFAD Asia and Africa
  - Country level investments:
    - EU in Asia and Africa
  - Strong case for RTB as a platform to address shared challenges, and broaden impacts together (multiple crops)
- iii. Commercial pathways to scaling
  - Sweet potato business-to-business partnerships (US-Africa)
  - RTB FP4 role: technologies, knowledge transfer, development impacts
  - Opportunities for research on scaling (under flagship 5)

## Overview of Cluster 4.1

### Demand-led Approaches to Drive Post-Harvest Innovation and Nutritious RTB Products

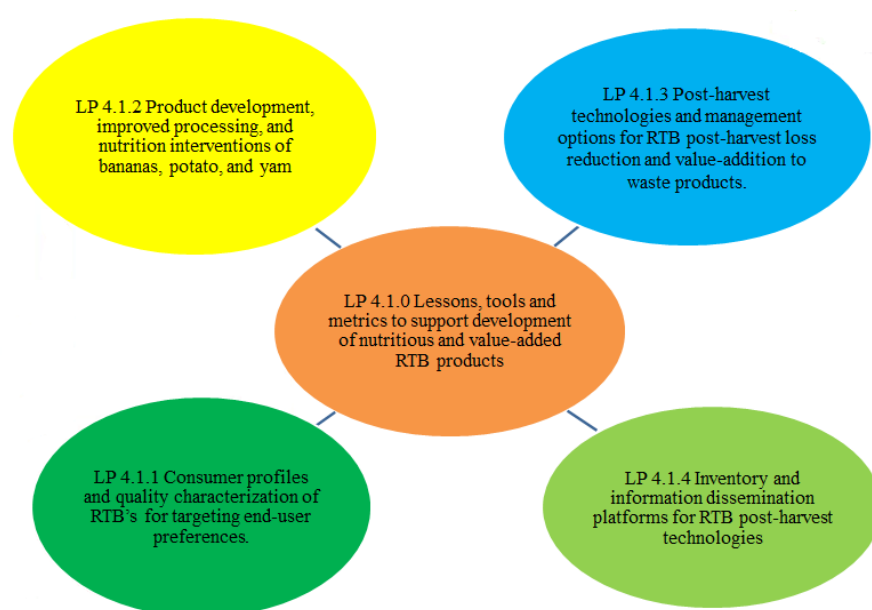
*Presented by Busie Maziya\_Dixon (IITA) [Day 1 - Session 1 Overview\RTB PH Innovations - CoA 4.1.pptx](#)*

Busie Maziya-Dixon presented an overview of cluster 4.1. The cluster aims at improving food and nutrition security and diets as well as providing income and employment opportunities for households. The cluster’s geographic coverage extends from Africa to Asia and Latin America.

Specifically, the cluster aims at:

- Accelerating RTB post-harvest innovation and nutrition improvement by integrating technology, social and economic research
- Harnessing the untapped potential for improving processing, enhancing post-harvest management and reducing post-harvest losses of RTB crops
- Targeting the changing needs and preferences of upcoming urban markets through product and value chain development
- Enabling producers and processors to increase food safety and quality
- Providing support to crop clusters in Flagship project four (FP4)
- Enabling effective linkages with postharvest and nutrition related research in Flagships 2, 3 and 5.

## Lead and linked products



The lead product (LP) is the center-piece for the convergence of the different products.

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

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

## Ongoing work and missing elements in post-harvest innovations

This session comprised of presentations on on-going work and missing gaps that were identified in the strategy development workshop back in June. Later, participants were divided into working groups to update lists of the on-going work that was not included as well as more gaps that were identified. The additions are listed below for each category.

## Consumer Profiles and Quality Characterization of RTB for Targeting End-user Preferences

Presented by Enoch Kikulwe (Bioversity International) [Day 1 - Session 1 Overview\RTB PH Innovations - WG 1 - Consumer profiles.pptx](#)

Ongoing work (additions)	Missing gaps	Remarks
Consumer profiling and preferences for RTB crops and their products (e.g. banana flour for porridge)	<ul style="list-style-type: none"> <li>• Characterizing suitable varieties for processing for industrial and domestic use - (cooking, tasting and pasting properties) e.g. biscuits, starch, puree, wine and other beverages</li> <li>• Nutritional and anti-nutritional (Proximate) composition of the various varieties (to understand how each variety will behave (in terms of chemical, physical properties)</li> <li>• Profile products – Sensory profiles using sensory descriptors of products (depending on the sensory properties – texture, flavor, color) e.g. industrial use</li> <li>• Link consumer attributes to the chemical attributes (cross-cutting for all RTB crops including bio-fortified banana)</li> <li>• Consumer education campaigns for RTB crops and their products to change the consumer mind-set</li> <li>• Changes in trends (diets, how much are RTB crops contributing to the consumer nutritional needs) address: packaging to suit consumer needs</li> <li>• Effect of introducing a new technology (e.g., waxing, extending shelf life) on the sensory and consumer acceptability</li> <li>• Standardizing protocols (SOP) replicability of studies and procedures</li> <li>• Intellectual Property Rights for processed products</li> <li>• Capacity building for the private industry to meet standards (guidelines).</li> <li>• Support RTB stakeholders to participate in standards development</li> <li>• Pioneers to support others in the region who are moving towards certification</li> <li>• Determination of nutritional losses of RTB products along the value chain</li> <li>• Branding and Labelling: conforming to acceptable standards</li> <li>• Simple tools to assess nutritive quality of produce as it enters the market (for smallholder farmers)</li> <li>• Effect of bioactive compound degradation on the consumer acceptability and</li> </ul>	Need to take note of location effect for various crops (in terms of altitude)

	profiling of RTB products (non-food uses of RTB commodities) <ul style="list-style-type: none"> <li>• CBA for all the proposed interventions and business models</li> <li>• Profiling RTB non-food products</li> <li>• Predicting consumer behavior towards RTB crops and products</li> <li>• Mapping consumer preferences across regions for differentiated RTB products</li> </ul>	
Bio-fortification of banana for micronutrients	<ul style="list-style-type: none"> <li>• Need to link up with A4NH</li> <li>• Consumer profiling</li> <li>• Product development (needs to be addressed under CC 4.1.)</li> </ul>	
Production of starch from banana	<ul style="list-style-type: none"> <li>• How to produce starch from banana</li> </ul>	Adapt procedure of extracting starch e.g. as done in Nigeria
Sweet potato in Nigeria	<ul style="list-style-type: none"> <li>• Physical chemical characterization of products</li> </ul>	
Plantain in Nigeria	<ul style="list-style-type: none"> <li>• Physical chemical characterization of products</li> </ul>	
Quality of stored ware potato	Understanding changes in root composition and acceptability after different periods of storage: follow up on work done by MSc students in RTB-ENDURE	
Sweet potato flour	<ul style="list-style-type: none"> <li>• Composite flours</li> <li>• More work needs to be done on OFSP flour consumer profiling</li> </ul>	
Sensory and consumer profiling of yam, sweet potato, plantain value added products		
Sensory and consumer profiling of other value-added products from cassava besides <i>gari</i> and <i>fufu</i>		
Gender differentiated consumer traits in banana hybrids NARITAS (ongoing)	<ul style="list-style-type: none"> <li>• Consumer and sensory profiling</li> </ul>	
Consumer profiling for peeled and stored bananas (ongoing)	<ul style="list-style-type: none"> <li>• Follow up on the work done in RTB-ENDURE</li> <li>• Variety characterization</li> </ul>	

## Product development, improved processing, and nutrition interventions of bananas, potato and yam

Presented by Kirimi Sindi [Day 1 - Session 1 Overview\RTB PH Innovations - WG 2 Marketing.pptx](#)

The presentation focused on the work underway regarding product development and processing as well as the lessons learnt from the processing work for markets. The key things to note:

- ❖ Gender is an issue when it comes to processing and marketing of the product- who captures the benefits (Youth, Women or Men)
- ❖ Branding is a key for success
- ❖ Linkages with industries is key for adoption and availability in the market
- ❖ We the researchers should continue the facilitators' role
- ❖ Research and development should be taken serious always to ensure that these products are successful

Ongoing work not included in the presentation was captured and more missing work was noted as shown below.

ONGOING WORK (ADDITIONS)	
<b>Product development and processing</b> <ul style="list-style-type: none"> <li>Utilizing Yam peels for growing mushrooms – Federal Institute Industrial Research (Nigeria)</li> <li>Utilizing Banana fibers into bags, paper, textiles, and other products – Uganda</li> <li>Selling of peeled frozen Bananas vacuum packed – Uganda</li> <li>Characterization and profiling of Yam products – Africa Yam IITA</li> <li>Utilizing the colored Potato for niche Potato crisp market – South America</li> <li>Potato crisps businesses at micro-enterprises</li> <li>Frozen potato for chips industry – East Africa and Nigeria</li> <li>Utilizing Banana peels to grow starter culture for manufacturing sweet potato <i>Fufu</i></li> <li>Utilizing of Banana peels to make Bio-fuel and Bio-plastic – Nigeria</li> <li>Marking of Charcoal briskets from banana peels</li> <li>Storage temperature for peeled and unpeeled bananas</li> <li>Optimal harvesting time for all the crops</li> <li>Market research for product development for new products</li> </ul>	
MISSING ELEMENTS	
<b>Product development and processing</b> <ul style="list-style-type: none"> <li>Requirement for continuous product development</li> <li>Dried yams and bananas for export</li> <li>Utilizing flash driers for processing the three crops</li> <li>Processing parameters for chips</li> <li>Extraction of bio-active compounds for pharmaceutical industry</li> <li>Enhancing self-life for the product cost effectively</li> <li>Understanding the molecular starch structure for all the three crops that affects processing</li> </ul>	
<b>Utilization of waste</b> <ul style="list-style-type: none"> <li>Utilizing of banana, yams, and potato peels to grow mushrooms (cross cutting across crops and countries)</li> </ul>	



<b>Harvesting and post-harvest handling</b> <ul style="list-style-type: none"> <li>• Mechanization of harvesting of all the three crops</li> <li>• Delayed banana ripening</li> <li>• Better cost-effective ways to store potato after harvesting</li> </ul>
<b>Socioeconomic activities</b> <ul style="list-style-type: none"> <li>• Ascertain demand dynamics for potato in urban areas</li> <li>• Consumer profiling and willingness to pay for products from the three crops</li> <li>• Gender integration in product development</li> <li>• Work on impact of commercialization of the three crops on family food security and other externalities due to gender dynamics</li> </ul>
<b>Marketing activities</b> <ul style="list-style-type: none"> <li>• Work on product promotion and marketing</li> <li>• Public private partnership for products development and marketing</li> </ul>
<b>Nutrient intervention</b> <ul style="list-style-type: none"> <li>• Effect of processing on the product safety across all the crops</li> <li>• Diversified yam varieties in the East African region to increase product diversity and nutrition</li> </ul>

## Post-harvest technologies & management options for RTB post-harvest loss reduction & value-addition to waste products

*Presented by Dietmar Stoian, on behalf of Dominique Dufour (CIRAD) [Day 1 - Session 1 Overview\RTB PH Innovations - WG 3 - Value adding.pptx](#)*

Dietmar gave an overview of the ongoing work and the missing work regarding post-harvest loss reduction and value addition to waste products, based on the overview resulting from the first stakeholder workshop held in June. The participants identified additional elements to be considered as we go forward, including:

- Market research for alternative products
- Refinement of harvest / post-harvest protocols
- Extension of green life / shelf life especially for banana and cassava
- Semi-finished products (e.g. puree, HQCF) and finished products (beverages)
- Adding value to by-products and residues (e.g. compost, biogas, feed)
- Use of cassava and yam leaves for food
- Storage, preservation and waxing
- Preservation for better intervention in the market
- Drying technology for yam and potato
- Value addition to waste: using banana pseudo stems and peels as feed
- Storage of cassava and banana
- Packaging of products
- Integration of private sector
- Processing honey with banana juice
- Formulation of diets
- Integrating indigenous knowledge in RTB post-harvest

# Inventory and Information Dissemination Platforms for RTB Post-harvest Technologies

Presented by Thierry Trans (CIAT) [Day 1 - Session 1 Overview\RTB PH Innovations - WG 4 Information dissemination.pptx](#)

Thierry summarized the ongoing work regarding inventory and dissemination platforms and the missing areas that were identified in the strategy development workshop earlier on in June. The participants identified some additional key missing areas including:

- Gender responsiveness in dissemination activities
- Exposure visits between countries
- Tapping into government extension agencies
- Curricula of agricultural and agro-industrial schools
- Training students on innovations, so they can take and apply them.
- Strong extension services at local level
- Social interactions, close to the (target) community, in the long-term
- Use of ICT/social media and use of conventional media e.g., TV, Radio. These reach different segments of the population
- Using drama & role-plays to put the message across
- Mini-videos can also be broadcast
- Translations into local languages to reach the target audience
- Demonstrations: need for funds to keep them functional. Funds can be from the users or projects. Willingness to pay by farmers/ users to be established
- Utilize Innovation Platforms, Farmer Field Schools (FFS) and Farmer field days
- Need to stay relevant; research is poor at this; need to involve NGOs

## Questions and answers

- There are several products being developed –does this project link with those on other products under development in Uganda? There is a need for updating the list on ongoing work in banana.
- Standard sensory procedures were mentioned among the gaps. How are the sensory procedures done for the products? These are mostly done by NARO through panels where people score for texture and taste. Experts are used to score the products.
- Banana is missing among the RTB crops, also missing in terms of post-harvest losses. This is so because minimal work has been done on banana thus far.
- What is the potential of banana in terms of starch production? Banana is usually bred for food quality. Banana is used for producing flour. It has a lot of fiber; so, it might not be easy to extract starch from banana.
- PPD concentration: when you increase dry matter content, you increase PPD. How do you deal with that? There is a trade-off. Some varieties have high dry and less PPD.
- Pruning cassava – don't you lose out on value as you prune? No, pruning helps break down the sugars.
- OFSP being low on dry matter, but this depends on the variety. This is not a challenge for processing.
- Fiber development from residues; fiber that can be processed into cloth. This is a blind spot.

## Plenary discussions to identify synergies across groups

Having discussed and shared ideas on what is being done currently and the missing gaps as far as post-harvest innovations are concerned, synergies across the groups were identified.

### Identified synergies across the groups

- Consumer profiling
- Product promotion (packaging, branding, labelling, awareness campaigns)
- Gender-responsive research
- Shelf life extension (cost-effective)
- Economic issues i.e.: Willingness to Pay (WTP) and Cost-benefit analysis (CBA)
- Bridging research & end-users' preferences of products

## Ongoing country/regional post-harvest innovations

Representatives from Uganda, Nigeria, Vietnam and Ecuador/Peru presented the progress of the ongoing work regarding post-harvest handling, product development and processing of RTB in their respective countries. The challenges and opportunities involved were highlighted. Gaps, lessons learnt and the way forward were summarized.

### Uganda perspective

*Presented by Steven K. Tumwesigye (NARO) [Day 1 - Session 2 Country perspectives\RTB PH Innovations - Uganda.ppt](#)*

Steven Tumwesigye presented challenges and concerns in the agri-food sector that the department of food biosciences and agribusiness of NARO addresses. Some existing opportunities were also highlighted. Challenges include: 1) food safety issues along the value chain, 2) high food losses, 3) high levels of malnutrition especially among infants, 4) insufficient skills in value addition, and 5) slow adaptation to rapidly changing market requirement where demand is increasing due to changes in tastes and lifestyles as well as technological advancements and innovations. Existing opportunities that can be tapped into include: 1) improvements in nutrient content of commodities at breeding level, 2) presence of new markets and new demands due to the rapid rates of urbanization, 3) rapidly developing agri-food industry, and 4) current government policy that supports value addition and agribusiness.

The national mandate of the food biosciences research program is to provide services and generate technologies, innovations and management practices through client-demanded research in food processing, preservation, nutrition, storage, packaging, bio-function, bio-chemical process engineering, quality, safety, markets and agribusiness.

The technologies that are currently being researched on include:

- 1) Shelf life extension/post-harvest loss reduction, including: waxed cassava, peeled/unpeeled cooking banana, and sweet potatoes.
- 2) Storage and packaging such as metallic silos, plastic silos and cocoons and super-bags
- 3) Bio-economy and clean environment, including optimized process for producing bio-degradable from crop wastes

The agribusiness enterprises that are currently being supported by the food bio-sciences and agribusiness research program are listed in the table below.

Business name	Business description	Status
Masupa enterprises	Briquettes, energy-saving stoves	Market testing
Variety Plus Uganda Limited	HQCF, snacks	Market testing
Biospore Uganda Limited	Spawn, mushroom products	On-market
JMS holdings and BANOTU Enterprise	Processed beans	Product development
Jah New Life Center	Composite flour formulae	Market testing
Super Products	Banana	Product development
Dream Farm	Dairy products	Product development
AYAL Limited	Bio-degradable products	Product development

## Nigeria perspective

Presented by Ugo Chijioke (NRCRI) [Day 1 - Session 2 Country perspectives\RTB PH Innovations - Nigeria.pptx](#)

Ugo Chijioke gave an overview of RTB value chains in Nigeria/West Africa. Different projects have different mandates in the various groups of post-harvest innovations as highlighted below:

### Consumer profiles and quality characterization of RTB for targeting end-user preferences

The *NEXTGEN* project has captured gender-differentiated cassava traits preferences in southwest and southeast Nigeria. Through the *BioMassWeb* project, food value of pro-vitamin A cassava varieties has been investigated through the characterization of their starchy roots, developing innovative processing methods to improve food uses, and vitamin A retention in the processed food products. Under the RTB Project (CGIAR & NARS), consumers' acceptability and willingness-to-pay for composite bread baked with High Quality Cassava Flour (HQCF) from yellow-fleshed cassava roots was assessed, whereas characterization and consumers acceptability of *gari* in Sierra Leone was also conducted, among other studies. The other projects on consumer profiles and quality characterization include: NRCRI *Umudike* project, *AfricaYam* project and PEARL project.

### Product development, improved processing, and nutrition interventions of RTB

Under the FIRO project vast research has been done in this area and numerous products have been developed:

- instant pounded yam flour using flash dryer (WAAP Project)
- cassava macaroni noodles
- African fries from *D. rotundata* and *alata*
- baked chips from orange-fleshed sweet potato
- custard powder from white-fleshed cassava starch
- instant plantain flour

The RTB project has conducted studies on: 1) nutritional and sensory properties of *amala* supplemented with distiller's spent grain (DSG); 2) nutritional and sensory properties of snack food

made from high-quality cassava flour and legume blend; and 3) development of an optimized cassava starch-based custard powder among others. The *BiomassWeb* project has conducted studies on screening of some cassava starches for their potential applications in custard and salad cream production; determination of cassava (yellow fleshed) starch's suitability for non-traditional food (noodles) manufacture; and production of high quality yam flour for confectionaries and pastries production, to mention but a few. The other projects involved in product development, improved processing and nutrition interventions of RTB include: IFAD/HQCF project, C: AVA project, NRCRI *Umudike* project and the Centre for food technology and research World Bank project.

### **Post-harvest technologies and management options for RTB postharvest loss reduction and value-addition to waste products**

A substantial amount of work has been done regarding value-addition to RTB waste products especially in mushroom production where cassava peels and stems as well as yam peels are utilized. The influence of Neem treatment on storage stability of three yam species and its effect on the quality of the products was examined among other studies.

### **Inventory and information dissemination platforms for RTB postharvest technologies**

Dissemination of information has been done through trainings of RTB value-chain actors; use of social media (Facebook, Instagram, WhatsApp); innovation platform linking the value chain actors; and use of mobile phones and webinars (YouTube). Information has also been shared through jingles and phone-in programs on radios and television; through use of the internet and subgroups as well as through extension services (Training of trainers).

### **Gaps in on-going country/regional post-harvest innovations on RTB**

The presentation was concluded with a summary of the gaps in the on-going country/regional post-harvest innovations on RTB namely:

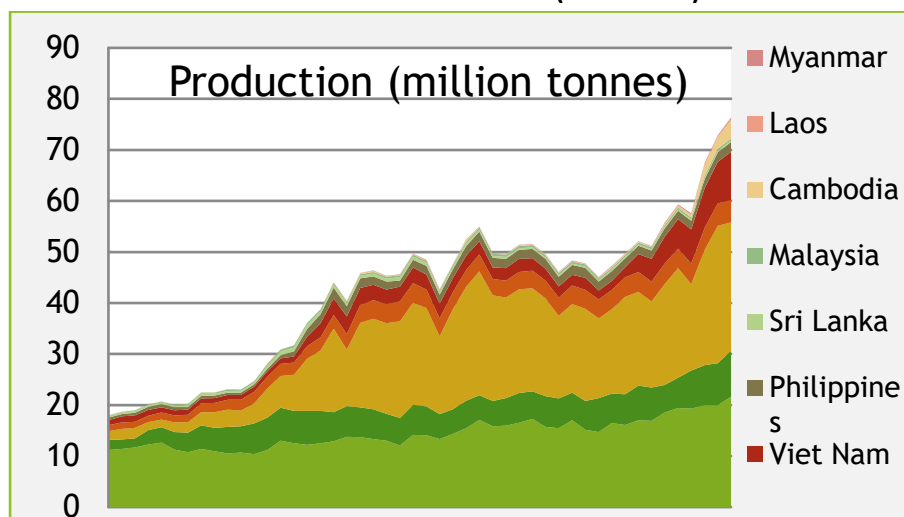
- a. Consumers and sensory profiling of yam, banana (plantain) and sweet potato value added products
- b. Scaling out of improved postharvest technologies on yam, banana (plantain) and sweet potato
- c. Fortification and nutrient improvement of yam, banana (plantain) and sweet potato
- d. Optimization of yam, banana (plantain) and sweet potato value added products

### **Vietnam perspective: a case of cassava and canna**

*Presented by Nguyen Khac Quynh (Vietnam Academy of Agricultural Sciences) [Day 1 - Session 2 Country perspectives\RTB PH Innovations - Vietnam.pptx](#)*

A considerable increase in production and area covered by RTB in Asia has been observed mainly in Lao, Myanmar, Cambodia and Vietnam. There has been an increase in the area cultivated and the amount of RTB produced. The area under cassava production has increased by 20% in Southeast Asia mainly in Thailand, Indonesia, Vietnam and Cambodia in the last ten years. As a result, over 90% of the internationally traded cassava is from these regions.

## CASSAVA PRODUCTION IN SOUTHEAST ASIA (1990-2010)



### *Cassava Production and processing in Vietnam*

Cassava is the third most important food crop after rice and corn in Vietnam. It is also ranked the third most important export commodity after rice and coffee. Its production has increased by 2.5 times within the last 10 years. There has also been drastic advancement in production from hand to mechanization.

The main products processed from cassava include: starch, flour, chips, animal feed, monosodium glutamate (MSG), maltose and glucose. There were 60 large factories involved in processing starch from cassava in 2005, which increased to 109 in 2016. The current production capacity of starch is about 20,000 tons per factory per year. Significant improvement has occurred in cassava processing technology from 5-10 tons/day in 2005 to 100-120 tons of fresh cassava per day at present. Waste water from starch processing factories is treated rather well and reused for washing roots. Biogas from digesters is used for drying starch and residue or electric generators. The residue from cassava is used as animal feed.

There were about 2000 small and medium scale factories with a processing capacity of 2-5 tons of fresh cassava root per day in 2005. Currently, the number of these factories has reduced to about 1000, but the processing capacity has increased to 10-100 tons of fresh root per day. This indicates a gradual improvement in technology and labor productivity.

There are seven ethanol factories using cassava as a raw material and producing 200-300 million liters/year but not efficient. There is great potential but the user has not yet adapted to the new fuel because it is not really trusted. There is low recovery of dry ethanol producing 1 liter/2.2-2.5kg dry cassava chip.

### *Challenges associated with cassava production & processing in Vietnam*

Challenges in **production** include: soil fertility degradation and erosion; new disease and pest outbreak (*Pink Mealy bug*, *Cassava Mosaic Virus*, *White fly*); and high labor requirement, while in **processing** they include: environmental pollution by wastes from starch processing, especially small-scale factories in villages; and processed products are not very diversified. Other challenges are **market-**

**related**, including: highly dependent on the China market; and price fluctuation and instability of both inputs and outputs.

### ***Canna Production in Vietnam***

Canna is a good root crop for reducing soil erosion in mountainous areas and good for supporting cassava production. It is planted at high altitudes ranging from 1000-1500 meters above sea level, mainly in the mountainous provinces. The yields range from 40-80 tons per hectare.

Canna is mainly processed by small and medium scale factories processing between 20-100 roots per day. The technology in these factories is like that used in cassava processing. The starch processed from canna is used for making noodles.

Challenges associated with canna production and processing include: products and varieties are not diverse; diseases like leaf blast, stem and root rot; and pollution by waste water from processing.

### ***Priorities for research and development of cassava and canna***

- Research into developing suitable processing technologies for remote areas
- Research on technologies to diversify products from cassava and canna (i.e. modified starches)
- Study on selection of main insect/disease resistant varieties and application of IPM, ICM on cassava and canna production
- Continue researching on integrated farming practices to reduce soil erosion in cassava production
- Research on value chains of cassava and canna in different ecological regions for sustainable development
- Transfer of cassava and canna processing technologies should be prioritized
- Pollution treatment in root crop processing villages should be accorded attention
- Exchange of PGR on RTB between countries under BI rules

### **Peru perspective**

#### **Exploring post-harvest research opportunities for sweet potato in Ecuador: Consultation with key public & private stakeholders**

Presented by Claudio Velasco (CIP) [RTB 4.1 MEETING 19 10 17\Day 1 - Session 2 Country perspectives\Research opportunity in Ecuador.pptx](#)

In his presentation, Claudio Velasco highlighted the constraints and opportunities of sweet potato production and processing in Ecuador. Among the key constraints were: high transport cost, to many intermediaries, and low standardization of quality. He shared research ideas/opportunities to solve the problems and these were categorized into those related to: consumer profiles and quality characterization of potato & sweet potato for targeting end-user preferences; product development improved processing, and nutrition interventions of potato & sweet potato; and inventory & information dissemination platforms for potato & sweet potato post-harvest technologies.

## Questions and answers

- Trade-offs: issues of potato chips causing obesity; analysis of the trade-offs hasn't yet been done. However, the demand for the potato chips is increasing year after year and they have tried to incorporate required nutritional requirements in the processed products.
- Weak national sweet potato research program caused mainly by lack of research on sweet potato in the last 5-8 years. CIP is considered as a great asset in this regard.



# Proceedings of workshop Day 2

Day two started off with a recap of the previous day's activities and lessons learnt. Then insights from a major funding proposal were shared after which the participants broke out into groups to identify key elements for funding proposals and tease out the priority areas. Later in the afternoon, they came together to report what had been discussed and the synergies across the groups were identified. The roles of the stakeholders in proposal development were also noted. Closing remarks were given by Dietmar Stoian and Busie Maziya-Dixon.

## RTB post-harvest innovations: insights from developing a major funding proposal

*Presented by Dominique Dufour (CIRAD) [Day 2 - Session 1 RTBfoods\RTBfoods overview 2017.pptx](#)*

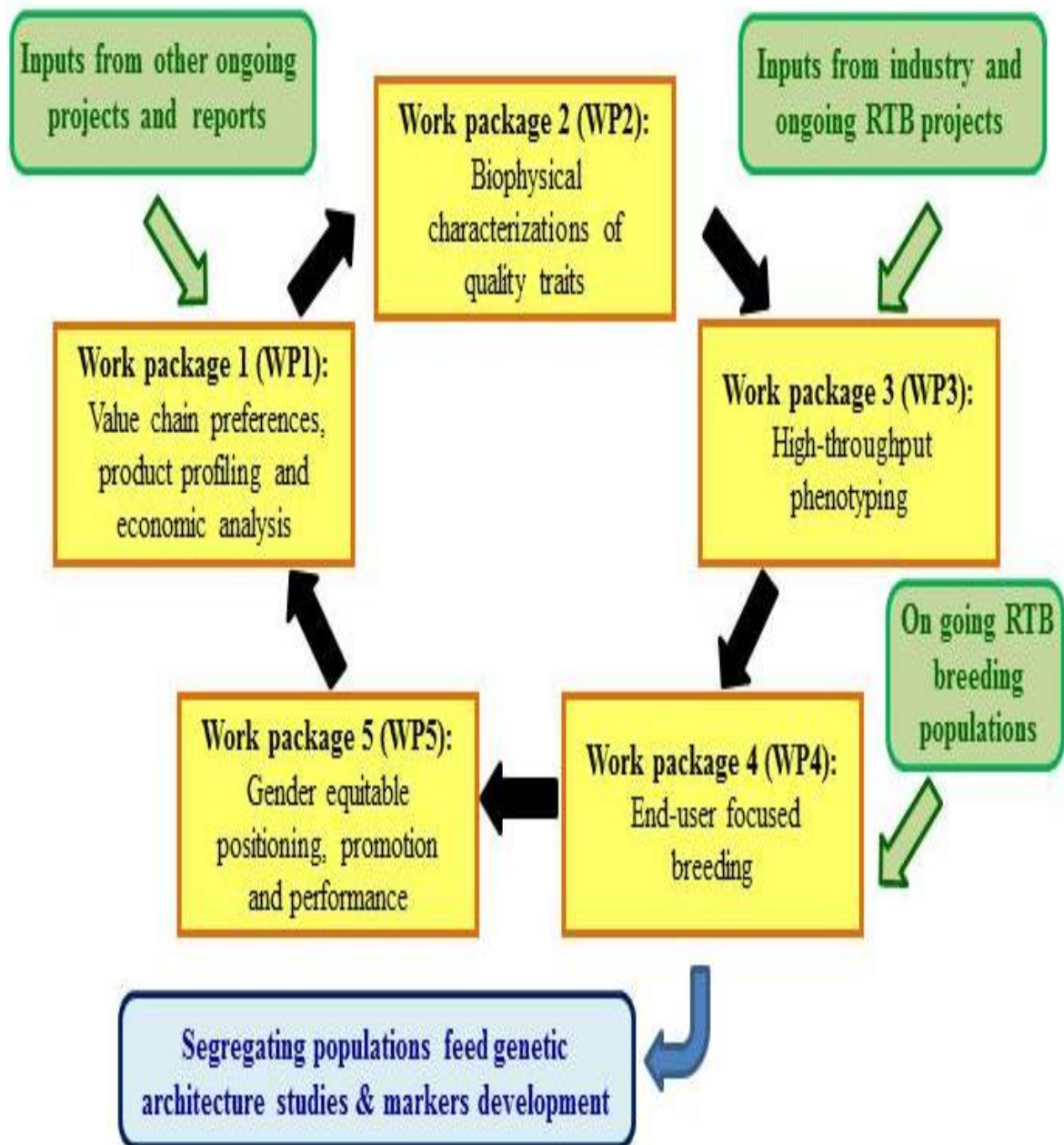
Proposal development is a process involving long-term work. It is imperative that the problem at hand is clearly stated and the proposed steps involved in solving the problem/bridging the gap are elaborately outlined.

Dominique shared insights from a proposal on breeding RTB products for end-user preferences (RTBfoods). Significant progress has been made in improving food security depending on RTB crops by increasing yields and the stability of performance through resistance to biotic and abiotic stresses. However, the deployment of new RTB varieties has identified weaknesses in terms of end-use quality that were exposed only after participatory consultation and varietal evaluation undertaken by farmers, processors and end users. RTB breeders generally lack access to the selection tools needed to evaluate end use quality early enough in the selection. Breeding designs have often led to lower than expected rates of adoption of new RTB varieties. Generally, the lack of participatory approaches, the scarcity of genotype by environment analyses, and their consequent effect on postharvest criteria need to be addressed. Furthermore, gender and socio-economic issues are usually not addressed by breeders. The acknowledgement of socio-economic and cultural-context differences is paramount.

He emphasized that future breeding effort with RTBs in Africa need to guarantee that the resulting products not only stand out for their agronomic performance but also meet the expectations of different actors in the value chain, taking gender and social differences into account at all stages of iteration. Therefore, the main objective of this investment is deploying RTB varieties that meet user-preferred quality traits to increase the adoption and impact of improved RTB varieties (cassava, yam, sweet potato, banana, potato) in sub-Saharan Africa (SSA).

The research proposal includes a cycle of iterative problem-solving work packages as shown in the figure below.

## Project coordination



## Identification of key elements for funding proposals

The criteria used for identification of key areas for funding included: cross-cutting nature of the idea, geographies, and its impact potential. This was done for each linked product.

### Consumer profile and quality characterization of RTB for targeting end-user preferences

Theme 1				
Product line	Activities	Cross-cutting	Target Countries	Impact potential
Profiling RTB varieties and products for gender responsive end user preferences	<ul style="list-style-type: none"> <li>Effects of RTB crop products with extended shelf-life (such as preserved peeled banana, waxed cassava, flash dried yam and cassava flour, dried yam chips, stored ware potato, cured sweet potato roots) on the sensory and consumers acceptability of women, men and youth</li> </ul>	All RTB crops	All	High
	<ul style="list-style-type: none"> <li>Characterizing suitable varieties for processing for industrial and domestic use in a gender responsive manner - (cooking, tasting and pasting properties) e.g. biscuits, starch, puree, wine and other beverages</li> </ul>	All RTB crops	All	High
	<ul style="list-style-type: none"> <li>Nutritional and anti-nutritional (proximate) composition of the various varieties (to understand how each variety behaves – in terms of their chemical and physical properties) to address gender concerns</li> <li>Mapping gender responsive consumer preferences across regions for differentiated RTB products</li> <li>Profile gender responsive products – Sensory profiles using sensory descriptors of products (depending on the sensory properties – texture, flavor, color) e.g., industrial use and domestic use</li> </ul>	All RTB crops	All	High
Changes in trends (diets, how much are RTB crops contributing to the consumer nutritional needs) to suit gender responsive consumer needs	<ul style="list-style-type: none"> <li>Predicting women, men and youth consumer behavior towards RTB crops and products</li> <li>Baseline and impact studies</li> </ul>	All crops	All	High
Gender responsive Business Models	<ul style="list-style-type: none"> <li>CBA and cost-effective analysis</li> <li>Willingness to pay</li> <li>Gender studies</li> </ul>	All crops	All	High

**Product development, improved processing, and nutrition interventions of bananas, potato, and yam**

<b>Theme 2</b>			
<b>Topic</b>	<b>Cross cutting nature (No, Yes)</b>	<b>Impact potential for scaling up (impact to the community) (Low, Medium, High)</b>	<b>Target countries</b>
<b>PRODUCT DEVELOPMENT</b>			
Development of nutritious products based on banana, potato, and yam with combination of other nutritious products like vegetables and legumes (Food to food fortification)	Yes	High	All RTB countries
Understanding potential market niche for products based on banana, yam, and potato	Yes	High	RTB countries
Develop gluten free; low glycemic index products based on potato, banana, and yams			
Development of gluten free and low glycemic products from Banana, Yam, and Potato	Yes	High	RTB countries
Develop new products targeted to livestock, pets, and game animals sector	Yes	High	RTB countries
Development of gluten free; low glycemic products from Banana, Yam, and Potato	Yes	High	RTB countries
<b>PROCESSING</b>			
Optimization of drying Process to make flour from potato, banana and Yams	Yes	High	RTB countries
Extending shelf life of raw and finished products	Yes	High	RTB countries
Optimization of processing methods for nutrient retention and reduction of anti-nutritional factors for banana, potato, and yam	Yes	High	RTB countries
Develop SOPs; CCPs; GMPs for the three crop and capacity building for industries	Yes	High	RTB countries
<b>NUTRITION INTERVENTION BASED ON POTATO, YAM, AND BANANAS</b>			
Enhancing linkages of private public partnership in food to food fortified products development and promotion for commercial, and developmental outcomes	Yes	High	RTB countries
To develop and promote school feeding programs utilizing bio-fortified and food to food fortification to fight malnutrition	Yes	High	RTB countries

Evaluation of school feeding programs in communities fed with products from banana, yam & potato	Yes	High	RTB countries
Assessing the impact of the consumption of banana, yam & potato products on the glycemic index among a group/country	Yes	High	RTB countries
Utilizing the bio-fortified crop to develop behavior change communication (BCC) programs for mother, infant, and young children feeding practices for nutrition outcome	Yes	High	RTB countries

### Post-harvest technologies and management options for RTB post-harvest loss reduction and value-addition to waste products

Theme 3			
Topic	Activities	Target Crop	Target countries
Extending shelf life of RTBs through exploring storage methods and farmer practices/activities; processing	<ul style="list-style-type: none"> <li>Indigenous storage; need to do a survey on existing methods for storage</li> <li>Implement storage capacity on farm before marketing and other levels of value chains</li> <li>Exploring different options of storage, including both indigenous and improved technologies (e.g. charcoal cooling, humidity storage)</li> <li>Handling and transportation for cassava, yam, sweet potato and bananas linked to farming practices- need to innovate specialized technologies and packages for better transportation</li> <li>Harvesting-standard and practices linked to curing for sweet potato, cassava</li> <li>Variety preferences in ripening ability for example OFSP has bad conservation, cassava dry matter stability all year round is low</li> </ul>	Banana  Cassava   Sweet potato   Plantain   Yam   Potato	Uganda  Uganda, Benin, Nigeria, Ghana, DRC, Sierra Leone, Cameroon  Uganda, Kenya, Ghana, Nigeria, Ivory Coast  Nigeria, Ghana, Cameroon  Nigeria, Ghana, Benin, Ivory Coast  Uganda, Kenya, Rwanda
Adding value to waste and residues	<ul style="list-style-type: none"> <li>Animal feeding as silage: feed composition with RTB</li> <li>Economic viability of adding value: for peeled bananas, cassava</li> </ul>	Banana (peels, pseudo stems & leaves). Cassava, yam & potato (peels).	All countries

	<ul style="list-style-type: none"> <li>• Exchange of experience between countries on adding value to waste</li> </ul>	Sweet potato (vines, peels & non-marketable roots)	
Product development	<ul style="list-style-type: none"> <li>• Development of peeled banana product to reduce nutrient mining on-farm.</li> <li>• Processing ripe highland bananas into juice,</li> <li>• Drying of bananas, sweet potatoes and cassava for baking purposes</li> <li>• Engage private sector on product development for more product development e.g. bananas for vinegar, textiles and other products</li> <li>• Sucker staggering technology for constant banana production</li> <li>• Analyze the economic potential of technologies along the value chain e.g. charcoal cooling-capacity</li> <li>• Understand gender roles in the processing of RTB crops</li> <li>• Why is there less use of machines in Cassava and other RTB crops in Africa?</li> <li>• Why women are the ones who peel most of the time?</li> <li>• Reducing drudgery through promoting gender responsive equipment like peeling machine, solar driers which also reduces losses especially cassava, sweet potatoes and yams</li> <li>• Initiate selling Peeled cassava – need for transportation technique to keep it fresh</li> </ul>	Banana  Cassava	Uganda  Uganda & Nigeria

## Inventory and information dissemination platforms for RTB post-harvest technologies

Theme 4				
Dissemination strategies	Users	Cross cutting	Scaling impact	Target countries
Demonstration centers (Climate-smart centers)	Farmers, processors	All cross cutting	Medium-high	RTB priority countries (Uganda, Nigeria, Vietnam, Peru, Columbia)
Social media	All (especially young people)		High	
Conventional media	All		High	
Drama	All		Medium	
Formal training for young people	Young people		Medium (long term)	
Agriculture/processing shows	Farmers, processors		Medium	
Users/cluster associations	Farmers, processors		High	
Private sector associations	Processors		High	
Vertical integration	Farmers		Medium	
Marketing, branding	All		High	

## Plenary discussion on synergies across groups

### Identification of key elements for funding proposals: feedback to the plenary

It was recommended that there is need to tap into technologies developed for harvesting potatoes and applying them in sweet potatoes. It was also suggested that scientists need to tap into indigenous knowledge for utilization of residues like cassava peels that are being utilized by farmers for processing local brew. Upscaling work on fresh cassava should be conducted in Kenya, Tanzania and Malawi, whereas Uganda and Kenya should be considered for research on white yams. Regarding dissemination strategies, it is important to use a combination of strategies for increased effectiveness.

### Higher priorities for higher impact: synergies

- Consumer profiling & quality evaluation: linkage between themes 1 & 2
- Extending the shelf-life concept for RTB crops for food & non-food sources
- Product development (to expand utilization & incomes)
- Residue/waste management for animal feed and other uses
- Concept note to come from themes 2&3 – Themes 1&4 as supporting themes
- Broadening & intensifying utilization of RTB crops (Reaching new markets, new products)

## Roles of stakeholders in proposal development

Stakeholder(s)	Role(s)
UNBS	Development and implementation of standards; Target markets and market channels for developed products
National Root Crops Research Institute UMUDIKE	Complement profiling, breeding, extension, product development
Farmers union	Have farmers organized in their societies; Tap into indigenous practices
Processors (banana wine)	Transportation issues of bananas to industries. Have certain desired varieties for processing, need to inform farmers regarding the preferred varieties. Packaging to prevent damage in transport
Universities (e.g., Uganda Christian University)	Interested in training in area of product development looking at value addition and preservation, consumer acceptability studies, adoption studies to incorporate in their communities
NARLRI (National Agricultural Research Livestock Resources Institute)	Develop and promote high quality products from local products. How to add value to residues (e.g. banana peels). Enable farmers to preserve peels for use in times of scarcity.
Excel Hort	ExcelHort is part of the private sector involved in processing different products from banana (e.g. juice, wines, textiles/crafts, fresh vacuum-sealed bananas, animal feed, banana biogas, vinegar, biodegradable bags) They are hosting the banana cooperative Union. Together with NARO, need to see the bananas being collected at the union centers. ExcelHort will be part of the actors involved in prolonging shelf-life. Can host the technology centers.
MAAIF	Organize farmers in groups, enable them access credit, train in PH handling, and create linkages between farmers & processors on the markets.
NARO (Food biosciences)	Develop shelf-life extension technologies, product development, sensory evaluation, value addition, incubation studies, products e.g. animal feeds from waste products & products of non-food use; banana-breeding; characterizing variety traits
FIIRO	Product development & shelf-life extension of RTB products thru drying technologies.
Sssemwanga Centre Limited	Temperature control storage experiments (private sector).



## Weaknesses/partner needs (human resources)

### Weaknesses/Lack of Expertise and associated partner needs (Human Resources)

[illegible]

	Ssemwanga Center, FIRO, Bioversity, MAAIF, MAK,		Kyambogo University, FAO
Value-adding to waste products	CIAT, CIP, IITA, UCU, ILRI, NARO, FIRO, Bioversity, MAK, polytechnic university in Vietnam		
Information dissemination	All CGIAR centers; NRCRI	Long-term support for dissemination platforms	Media
Gender-integration	CGIAR, NRCRI, MAK, AWARD, UCU, KYU		World Vision, Uganda Forum Agricultural Advisory Services

## Closing remarks

Dietmar Stoian thanked all participants for their valuable contributions and generating great ideas together. He noted that the stakeholder perspective is critical for ensuring that priorities for RTB post-harvest innovations are demand-oriented. He closed by stating that the outcomes of the workshop will serve as key inputs to the development of the CC4.1 cluster strategy and the crafting of funding proposals.

A vote of thanks was also given by Busie Maziya-Dixon, the CC4.1 Cluster leader, who emphasized the importance of cross-center collaboration for the success of the cluster. She urged the participants to respond positively when called upon especially in the process of proposal development to ensure that work on RTB progresses faster with everyone on board.

# Appendix

## Appendix 1: Agenda

16<sup>th</sup> OCTOBER 2017

TIME	ACTIVITY	RESPONSIBLE
7.45 – 8.15 am	Registration	Celea Naluburwa
	<b>Moderator</b>	<b>Busie Maziya-Dixon</b>
8.15 – 8.20 am	Welcome address by Bioversity regional and country representative	Eldad Karamura
8.20 – 8.25 am	Welcome address by NARO	Kephas Nowakunda
8.25 – 8.35 am	Workshop objectives and agenda	Dietmar Stoian
8.35 – 8.45 am	Overview of Flagship 4 – Nutritious RTB foods and value added through post-harvest innovation	Simon Heck
8.45 – 9.00 am	Overview of Cluster 4.1 – Demand-led approaches to drive post-harvest innovation and nutritious RTB products	Busie Maziya-Dixon
	Ongoing work and missing elements in post-harvest innovations	
9.00 – 9.15 am	Consumer profiles and quality characterization of RTB for targeting end-user preferences	Enoch Kikulwe
9.15 – 9.30 am	Product development, improved processing, and nutrition interventions of bananas, potato, and yam	Kirimi Sindi
9.30 – 9.45 am	Post-harvest technologies and management options for RTB postharvest loss reduction and value-addition to waste products	Dominique Dufour
9.45 – 10.00 am	Inventory and Information dissemination platforms for RTB postharvest technologies	Thierry Tran
10.00 – 10.30 am	HEALTH BREAK	HOTEL
10.30 – 11.00 am	Plenary discussion	Dietmar Stoian
	<b>Moderator</b>	<b>Thierry Tran</b>
	Ongoing country/regional post-harvest innovations	
11.00 – 11.30 am	The perspective of Uganda	Kephas Nowakunda
11.30 am – 12.00 pm	The perspective of Nigeria	Ugo Chijioke
12.00 – 12.30 pm	The perspective of Vietnam	Nguyen Khac Quynh
12.30 – 1.30 pm	LUNCH	HOTEL

TIME	ACTIVITY	RESPONSIBLE
	<b>Moderator</b>	<b>Dietmar Stoian</b>
1.30 – 3.30 pm	Break-out groups (by topics presented in the morning):  Prioritization of post-harvest innovations based on the inputs received during the morning sessions	Facilitators: - Enoch - Kirimi - Dominique - Thierry
3.30 – 4.00 pm	HEALTH BREAK	HOTEL
	<b>Moderator</b>	<b>Sarah Mayanja</b>

TIME	ACTIVITY	RESPONSIBLE
4.00 – 4.20 pm	The perspective of Peru	Claudio Velasco
4.20 – 5.00 pm	Feedback to the plenary: 5 minutes per group & 5 minutes clarification questions	Rapporteurs
5.00 – 5.30 pm	Plenary discussion to identify synergies across groups	Moderator & participants
5.30 – 5.35 pm	Wrap-up of the day and outlook on Day 2	Dietmar Stoian

## 17<sup>th</sup> OCTOBER 2017

TIME	ACTIVITY	RESPONSIBLE
8.30 – 8.40 am	Recap	Susan/Gloria
	<b>Moderator</b>	<b>Dietmar Stoian</b>
8.40 – 9.00 am	RTB post-harvest innovations: insights from developing a major funding proposal	Dominique Dufour
9.00 – 11.00 am	Break-out groups: Identification of key elements for funding proposals	Facilitators: - Enoch - Busie - Thierry - Kirimi
11.00 – 11.30 am	HEALTH BREAK	HOTEL
11.30 am – 1.00 pm	Break-out groups (cont.): Identification of key elements for funding proposals	Facilitators: - Enoch - Busie - Thierry - Kirimi
1.00 – 2.00 pm	LUNCH	HOTEL
	<b>Moderator</b>	<b>Dominique Dufour</b>
2.00 – 3.30 pm	Feedback to the plenary: 15 minutes per group & 7 minutes Q&A	Rapporteurs
3.30 – 4.00 pm	HEALTH BREAK	
	<b>Moderator</b>	<b>Busie Maziya-Dixon</b>
4.00 – 5.00 pm	Plenary discussion on synergies across groups	Moderator & participants
5.00 – 5.20 pm	Closing remarks	Dietmar Stoian Busie Maziya-Dixon Simon Heck

## Appendix 2: List of participants

Name	Institution	E-mail
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RESEARCH  
PROGRAM ON  
Roots, Tubers  
and Bananas

The CGIAR Research Program on Roots, Tubers and Bananas (RTB) is an alliance led by the International Potato Center implemented jointly with Bioversity International, the International Center for Tropical Agriculture (CIAT), the International Institute of Tropical Agriculture (IITA), and the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), that includes a growing number of research and development partners. RTB brings together research on its mandate crops: bananas and plantains, cassava, potato, sweetpotato, yams, and minor roots and tubers, to improve nutrition and food security and foster greater gender equity especially among some of the world's poorest and most vulnerable populations. [www.rtb.cgiar.org](http://www.rtb.cgiar.org)

