

Cluster annual report - 2017

CC4.1 – Demand-oriented Solutions for Value Adding Through Improved Postharvest and Risk Management.



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RTB Cluster Report

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1. MAIN ACHIEVEMENTS

This section provides a synthesis of main progress and achievements in implementing the annual Plan of Work. Fill this section considering the content of the RTB POWB 2017. In particular, review the files RTB-PMU provided with the reported Milestones and Outputs.

Use the two sections below to highlight achievement of milestones, outputs and key findings with gender, youth and capacity development relevance.

MAX 1500 characters


MAIN ACHIEVEMENTS WITH GENDER AND YOUTH RELEVANCE

A flyer based on post-harvest research conducted in Tanzania and Uganda; a brochure on banana marketing in Uganda; and a brochure based on collective action work in potato in Uganda were developed and available. A detailed guidelines document on gender mainstreaming into development of post-harvest technologies targeted towards scientists working on post-harvest innovations across RTB crops in Uganda was developed and available.

A report on a qualitative formative gender evaluation of the Viable Sweetpotato Technologies for Africa (VISTA) project implemented in seven districts in Tanzania (Mbeya, Iringa and Morogoro regions), which are part of USAID's (United States Agency for International Development) Feed the Future zone of influence is available. The report discusses the aims with the objective of influencing the project's strategies for training and rollout of technologies and of fostering the development of gender-responsive OFSP seed businesses. The report will be of interest to researchers and policy-makers aiming to expand the production and utilization of the nutritious OFSP. VISTA Tanzania seeks to (1) contribute to improved dietary diversity, food security and incomes in Tanzania, especially among households with children under five years of age; (2) expand the production, consumption, storage, utilization and marketing of orange-fleshed sweetpotato (OFSP) and its products; and (3) create financially viable sweetpotato seed and root enterprises to improve the sweetpotato value chain.

A strategy for gender mainstreaming into the 'Extending the Shelf-life of Fresh Cassava Roots for Increased Incomes and Postharvest Loss Reduction' one of the four sub-projects of the 'Expanding Utilization of RTB and Reducing Their Postharvest Losses' project (RTB-ENDURE) implemented in Uganda was documented. The main purpose of the strategy is to ensure that both men and women benefit from interventions for reducing postharvest losses, promoting innovative products and marketing innovations in the cassava value chain.

The International Potato Center (CIP) and its partners have recognized the importance of mainstreaming gender in research activities resulting in several strategic documents and studies to mainstream gender in several projects in Sub Saharan Africa (SSA) and Latin America (LAC). Four gender tools were developed and first used in the 'OFSP-AIS' project in Kenya, Tanzania and Uganda and were applied in RTB-ENDURE project. These tools include the gender responsive mapping tool, the gender-based constraints analysis tool, the comparison of the five dimensions of men's and women's empowerment tool (comparison tool), and the Risk-Benefit Analysis Tool. Two of the tools are ready to be rolled out i.e. the gender responsive mapping tool and the gender-based constraints analysis tool. Based on the feedback received the comparison tool and the risk benefit analysis tool



need to be revised and trialed internally in CIP before they can be re-validated and shared with the wider research and development community.


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Within the framework of the Flagship Project 4 (FP 4) of the CGIAR Research Program on Roots, Tubers and Bananas, the cross-cutting cluster entitled "Demand-led approaches to drive postharvest innovation and nutritious RTB products "provides a platform for strategic multi-crop research, learning, and dissemination to address strategic development challenges for postharvest management, utilization, and value addition of RTB crops. While crop-specific clusters on cassava (CC4.2 and CC4.3) and sweetpotato (SW4.4) implement research on utilization and value addition of RTB crops within FP4, CC4.1 plays a central role in synthesizing methodologies and results and fostering cross-crop learning. Its specific functions are: (1) analysis and synthesis of postharvest approaches, capacities, and results in order to generate information platforms, tools, metrics, and guidelines that can be applied and further adapted across all RTB crops; (2) research that cuts across RTB crops to systematically address strategic RTB-wide challenges, such as postharvest losses or waste utilization; and (3) crop-specific postharvest research on banana, potato, and yam which do not have crop-specific research clusters under FP4. Through earmarked funding an implementation and resource mobilization strategy based on a multidisciplinary approach that integrates technology, environmental, socio-economic and institutional research to better understand the opportunities, scope, and potential impacts of RTB postharvest interventions was developed. It learns from and provides support to crop-specific clusters inside FP4 and enables effective linkages with postharvest and nutrition related research in FP2, FP3, and FP5.

MAIN ACHIEVEMENTS WITH CAPACITY DEVELOPMENT RELEVANCE

RTB-ENDURE Cassava sub-project aimed at introducing, testing, validating the efficacy of two technologies for increasing the shelf-life of fresh cassava roots, and thereby assisting to increase the value to growers, traders and consumers along the entire value chain. These technologies included high relative humidity storage and waxing. It was focused on investigating and setting up the business cases for the two technologies in Uganda for the commercial applicability and viability. In doing so, the project set up two Packhouses using to test their commercial viability. They included one Packhouse managed by farmers and another managed by an entrepreneur. However, to facilitate the successful commercial operations of the Packhouses, the entrepreneurial and business skills of the operators was built. Thus, the project engaged in various capacity building process and activities that were done to enhance the business and entrepreneurial skills of Packhouse operators.

Sweetpotato silage manual was developed and it would benefit farmers and business entrepreneurs that would want to engage in sweetpotato silage making, marketing and use. The manual focused




on the piggery enterprise and covers five key aspects: importance of sweetpotato in small-scale farming systems, sweetpotato establishment and management, pig production in Uganda, sweetpotato as a feed resource for pigs, sweetpotato silage production. It is expected that the manual will give the reader incites for sweetpotato production and making sweetpotato silage to address feeding constraints.

There were series of studies conducted on yam in Nigeria. Survey was conducted to find landraces suitable for pounded yam production in Benue, Ebonyi, Enugu and Kogi States of Nigeria. The major landraces used for pounded yam in these states were Ogoja, Ozibo, Nwopoko and Uchu respectively. These varieties are highly rated because of their good textural characteristics (softness, mouldable and stretchable). In addition, a study was conducted to assess nutritional and antinutritional quality traits of 232 genotypes of yam (61 *D. rotundata* and 171 *D. alata*) grown at Abuja, Ibadan and Ubiaja locations. The results also showed that all genotypes had protein above 5.0 %, starch content above 50 % and amylose value above 25%. Results of PCA indicating that crude fibre, tannin and total ash are key traits followed by fat, starch and amylose. It has been well established that yam flour, either in the fermented or unfermented form, is produced from white yam (*Dioscorea rotundata*) or water yam (*Dioscorea alata*). There was study that was designed to find landraces suitable to produce instant pounded yam flour in Benue, Ebonyi, Enugu and Kogi States of Nigeria. The results obtained shows that white yam (*Dioscorea rotundata*) was produced in all four States and was the only species used by processors to produce yam flakes which was after milled into yam flour. Instant pounded yam flour technology is still lacking.

The acceptability of the yam flour is limited because of its dark color. There was an experimental investigation on the potential of developing novel food products using yam flour from *D. alata*. Seven varieties (TDA 00/00194, 02/00194, 297, 291, 01/00090, 00/00064 and 02/00045) were used for the study. Two products were developed: yam couscous and yam strips. In general, the sensory quality of the developed products were reflections of the properties of *D. alata*. Some of the products were very good while some were not good at all. The varieties that made good quality, acceptable products and their properties were found.

A longitudinal study was designed to find out what main pig feed resources farmers use and what are the current feeding practices on smallholder farms. The results showed that pig farmers mostly relied on sweetpotato vines and maize bran, weeds and cassava leaves to feed pigs in the dry season. Other types of feed used on farms in small amounts included home mixed rations, swill and cassava roots. The other feed ingredients used in small proportions were banana peels, cooked sweetpotato roots, cassava leaves, sweetpotato vines, avocado and weeds. There was a study to establish the characteristics and chemical composition of different silages based on sweetpotato vines in combination with several local feed resources. Sweetpotato vines from variety NASPOT 11 were used. Maize bran and cassava root were used as ferment starters (additives) during the ensiling process. The results showed that sweetpotato vines can produce silage of acceptable quality even when no external ferment starter is added. However, addition of a solid ferment starter like maize bran served to absorb the moisture that would accumulate as effluent at the bottom of the silo and eventually lead to spoilage. The resultant silage had crude protein content higher than 19 percent and would meet the requirements for growing pigs except for the balance of essential amino acids and low dry matter of the material. For efficient utilization, feeding sweetpotato silage diets would require supplementation to satisfy requirements for dry matter and essential amino acids. In




addition, a study was undertaken to assess the potential for sweet potato silage making business by estimating sweet potato vines and root wastage and assessing the economic feasibility of investing in sweet potato silage. The results showed that sweet potato production is seasonal with substantial wastage of sweet potato components existing across the various nodes of the sweet potato value chain. The study concludes that there is an opportunity for investment in sweet potato silage business that has the potential to reduce wastage of sweet potato and bridge the feed scarcity gap faced by pig farmers.

A study was conducted to evaluate potato clones and introduced varieties for production in Mt. Elgon region. This involved assessing the status of the ware potato marketing, including the underlying nature of the ware potato value chains, the postharvest management practices, market performance, and the level of pre-and postharvest losses along the value chains in Eastern Uganda. The study findings highlight the status of potato marketing, existing priorities, and workable recommendations that enhance market performance in Eastern Uganda. Pilot potato ambient storage facilities with a capacity of 45 tons have been introduced and piloted in eastern Uganda by the RTB-ENDURE project. As part of the project, storage trials were conducted to evaluate the storability of selected varieties. The results showed that potato on-farm storage in ambient store was a practical and potentially highly profitable business in eastern Uganda. Based on the results of this study, the following recommendations were made to ensure viability of the business. a) It is recommended that the construction cost of the storage facilities should be kept low; and promising innovations have been developed with last generation store (45 tons capacity) built at a cost of about \$6,000.

We conducted a survey to identify landraces suitable for pounded yam production in Benue, Ebonyi, Enugu and Kogi States. Purposive sampling was used to select three Local Government Areas (LGAs) in each of the selected States. Data were collected using a structured questionnaire from 200 respondents. Results obtained indicates that many varieties are good for pounded yam. The most preferred yam varieties for pounded yam preparation are Ogoja (50%), Ozibo (56%), Nwopoko (67.35%) and Uchu (70%) in Benue, Ebonyi, Enugu and Kogi States. The major reasons for acceptability of pounded yam from these yam varieties include smoothness, elasticity, mouldability, softness, taste and colour. In conclusion, the major landraces used for pounded yam in Benue, Ebonyi, Enugu and Kogi States are Ogoja, Ozibo, Nwopoko and Uchu respectively. These varieties are highly rated because of their good textural characteristics (softness, mouldable and stretchable).


In another study, we investigated the potential of developing novel food products using yam flour from *D. alata*. Specifically, we determined the starch, sugar, swelling, water binding capacity and pasting properties of the flour from selected varieties of *D. alata*; developed novel food products and conducted sensory evaluation of the developed. Seven varieties (TDA 00/00194, 02/00194, 297, 291, 01/00090, 00/00064 and 02/00045) were used for the study. Two products were developed: yam couscous and yam strips. Each product was evaluated by 8 semi-trained panelists using a ranking scale of 1-5 with 1 = liked extremely and 5 = disliked extremely. Results obtained indicates that significant differences were observed for the functional properties ($p < 0.05$). In general, the sensory quality of the developed products were reflections of the properties of *D. alata*. Some of the products were very good while some were not good at all. The varieties that made good quality, acceptable products and their properties were identified.



New market segments for fresh cassava roots have been emerging for both niche and mass markets. However, despite a growth in demand, both the utilization and income derived from marketing of fresh cassava roots are being hindered by the rapid postharvest physiological deterioration (PPD) that causes spoilage of cassava roots within two to three days of harvest. The implication is that it cannot be marketed over a long time and distance, thereby reducing incomes and food security to growers, consumers and traders. To address this challenge, the RTB-ENDURE Cassava sub-project also known as “Extending the Shelf life of Fresh Cassava Roots for Increased Incomes and Postharvest Loss Reduction” aimed at introducing, testing, validating the efficacy of two technologies for increasing the shelf-life of fresh cassava roots, and thereby assisting to increase the value to growers, traders and consumers along the entire value chain. These technologies included high relative humidity storage and waxing. The study to evaluate waxing and high relative humidity treatments for efficacy on PPD reduction was carried out. The results showed that the combined pruning with waxing or with high relative humidity storage results in enhanced shelf life of cassava. Sensory analysis of waxed roots been still acceptable and did not differ from freshly harvested roots up to 14 days of storage. Thus, waxing and high relative humidity storage can easily be recommended for adoption for commercial use in shelf life extension of cassava.

A dynamic human gastrointestinal (GI) model was used to digest tubers from purple-fleshed Amachi and Leona potato cultivars to study anthocyanin biotransformation in the stomach, small intestine and colonic vessels. Colonic Caco-2 cancer cells and non-tumorigenic colonic CCD-112CoN cells were tested for cytotoxicity and cell viability after exposure to colonic fecal water (FW) digests. After 24 h digestion, liquid chromatography-mass spectrometry identified 36 and 15 anthocyanin species throughout the GI vessels for Amachi and Leona, respectively. Leona FW showed greater potency to induce cytotoxicity and decrease viability of Caco-2 cells. Amachi FW caused cytotoxicity in non-tumorigenic cells while FW from Leona showed no effect. The present findings indicate major variations in the pattern of anthocyanin breakdown and release during digestion of purple-fleshed cultivars. The differing microbial anthocyanin metabolite profiles in colonic vessels between cultivars could play a significant role in the impact of FW toxicity on tumor and non-tumorigenic cells.

A sub-project on Reducing Postharvest Losses and Promoting Product Differentiation in the Cooking Banana Value Chain under the RTB-ENDURE project implementation was based on four approaches: (1) Reduction of postharvest losses through promotion of varieties with intrinsic longer shelf-life and better postharvest handling practices; (2) Increase in market access and transparency in unit pricing through product differentiation and piloting the weight-based pricing system; (3) Promotion of sucker staggering for evening-out banana production across seasons; and (4) Linking the different actors along the value chain to benefit from emerging untapped market opportunities based on product differentiation. The sub-project identified the challenges limiting the exploitation of business opportunities in the cooking banana value chains which include high postharvest losses (up to 14.94% of harvested bananas (corresponding to 42.7% of traded bananas); gender inequalities in resource access and utilization leading to imbalances at profitable nodes of the value chain and; mismatch between banana cultivars farmers grow, those produced by input suppliers and those preferred by the market, limited differentiation, short shelf-life of peeled bananas, limited access to support services (e.g., extension, credit, quality assurance, market information). The implementers were equipped and mentored with skills in use of PMCA (phase I and II) and gender integration.



100% of the PMCA approach was used by the project during situation analysis, thematic groups development, implementation of activities, feedback meetings, identification of champions (entrepreneurs), and preparation of the final event. Gender considerations were also mainstreamed in all the project activities and model families and role models for women have emerged. The sub-project trained over 500 farmers (of which 40% were women) in agronomy, cooking banana fruit quality assurance, marketing, business plan development, group dynamics, planting materials multiplication techniques and sucker staggering.

A study was undertaken to assess the potential for sweet potato silage making business by estimating sweet potato vines and root wastage and assessing the economic feasibility of investing in sweet potato silage. Information was collected through key informant interviews, secondary data review, sweet potato root peeling and weighing, focus group discussions with pig and sweet potato producers covering a sample of 180 farmers. Semi-structured interviews with 240 respondents (120 sweet potato farmers, 60 pig farmers and 60 sweet potato traders) were also conducted. The results showed that sweet potato production is seasonal with substantial wastage of sweet potato components existing across the various nodes of the sweet potato value chain. The study concludes that there is an opportunity for investment in sweet potato silage business that has the potential to reduce wastage of sweet potato and bridge the feed scarcity gap faced by pig farmers.

Potatoes are commonly regarded as a bulky, perishable commodity with high transport costs and limited export potential, confined mostly to cross-border transactions. The potato is a good source of dietary energy and some micronutrients, and its protein content is very high in comparison with other roots and tubers. Fresh potato consumption is the major form of utilization; however, processing has improved to meet rising demand from the fast food, snack and convenience food industries. The growing urban populations, rising incomes, the diversification of diets and lifestyles is the driver behind this new development. A guide on the basic principles for potato harvesting and storage to ensure good quality ware potato for enhanced market access and better prices was developed and available.

The RTB-ENDURE Cassava sub-project aimed at introducing, testing, validating the efficacy of two technologies for increasing the shelf-life of fresh cassava roots, and thereby assisting to increase the value to growers, traders and consumers along the entire value chain. These technologies included high relative humidity storage and waxing. It was focused on investigating and establishing the business cases for the two technologies in Uganda for the commercial applicability and viability. In doing so, the project proposed to set up two packhouses to test their commercial viability. They included one packhouse managed by farmers and another managed by an entrepreneur. To facilitate the successful commercial operations of the packhouses, it was necessary to build the entrepreneurial and business skills of the operators. A report describing the capacity building process and activities that were done to enhance the business and entrepreneurial skills of packhouse operators is available.

2. MAIN GAPS AND CHALLENGES

Describe the main challenges/bottlenecks encountered and the deviation from your annual plan of work. Provide results from independent evaluative studies or internal auto-evaluations and results from learning process, if any.

MAX 1500

There were no main challenges or bottlenecks encountered during the reporting year except that encountered during the preparation of the POWB. There was no contribution from CIAT and CIRAD and few from CIP. In addition, there was no deviation from the annual plan of work. The delayed release of earmarked funds resulted in the work planned for the year to be conducted in a short time.

MEASURES TAKEN, AND ADJUSTMENTS PROPOSED

Describe action taken to address challenges/bottlenecks

Provide an update on your theory of change if this is part of the adjustments proposed

MAX 1500 characters

Measures taken included encouraging all partners to contribute and map relevant activities to the cluster during the reporting period. This was achieved as the cluster had more deliverables than those planned at the beginning of the year entered as unplanned deliverables.

3. PARTNESHIPS: ACHIEVEMENT AND CHALLENGES

List of Key External Partnerships

Please list up to three important partnerships for 2017, using the following table.

FP	Stage of research*	Name of partner	Topic of partnership
			Please provide a short description of main activities and results obtained
FP4	1	Kwame Nkrumah University of Science and Technology (KNUST)	The main activities involve quality evaluation of the physico-chemical, functional and sensory characteristics, and the consumer acceptability of boiled/pounded yam made from selected yam varieties. Starch extraction and functional properties have been completed.
FP4	1	NARS and Universities in Benin Republic, Nigeria, Uganda, Ivory Coast, Cameroon and NRI (RTBfoods project)	Breeding RTB products for end user preferences (RTBfoods)

* Please mark: 1 – for Discovery/Proof of concept; 2 – for Piloting; 3 – for Scaling up and scaling out.

Status of Internal (CGIAR) Collaborations among Programs and between the Program and Platforms

Name of CRP or Platform	Brief description of collaboration (give and take among CRPs) and value added*	Relevant for RTB FPs
	Please provide a short description of main activities and results obtained	

*e.g. scientific or efficiency benefits

4. FUND RAISING

Provide an update on projects started or awarded in 2017.

1. Viable Sweetpotato Technologies for Africa (VISTA)
2. Sustained Diet Quality Improvement by Fortification with Climate-smart, Nutrition-Smart Orange-fleshed Sweetpotato (OFSP) in Southern Nations, Nationalities and Peoples, Region (SNNPR) project
3. Breeding RTB products for end user preferences (RTBfoods)

4. INNOVATIONS¹

List the innovations that: 1) have been made available for use to next-users in 2017; 2) have demonstrated uptake by next users in 2017.

Title of innovation (minimum required for clarity)	Corresponding output in MEL	Phase of research *	Partners involved	Geographic scope: for innovations in phases AV* or USE* only (one country, region, multi-country, global)
Four gender tools were developed.	8940	USE	OFSP-AIS RTB-ENDURE projects	Kenya, Tanzania and Uganda
Two technologies for increasing the shelf-life of fresh cassava roots (High relative humidity storage and waxing).	11138	AV	RTB-ENDURE	Uganda
Sweetpotato NASPOT 11 vines used to produce silage of acceptable quality even when no external ferment starter is added	11309	AV		Uganda
Sweetpotato silage manual for smallholder farmers	11310	AV	CIP, ILRI,	Uganda
Varieties suitable for pounded yam fufu and instant pounded yam fufu flour production.	9066	AV	NRCRI- Nigeria, CSRO-Ghana	Nigeria, Ghana, Benin
Yam varieties suitable to produce acceptable yam	9094	AV		Nigeria, Ghana, Benin

¹ Research and development innovations are new or significantly improved (adaptive) outputs - including management practices, knowledge or technologies.



products (yam bread) using carbohydrate polymers.			NRCRI-Nigeria, CSRO-Ghana	
Pilot potato ambient storage facilities with a capacity of 45 tons have been introduced and piloted.	11337	AV	RTB-ENDURE	Uganda
A flyer based on postharvest research	10982	USE	RTB-ENDURE	Tanzania and Uganda
A brochure on marketing based on ENDURE work	10984	USE		Tanzania and Uganda
Brochure based on collective action work in potato	10985	USE	RTB-ENDURE	Uganda
			RTB-ENDURE	

* Phases: AV - available/ready for uptake, USE - uptake by next users.