



Fund

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**Annex 2.6 - Promoting postharvest technologies,
value chains, and market opportunities**

(Approved with conditions, See FC5 Summary, Annex 5)

*Document presented for Agenda Item 11:
CRP 3.4 - Roots, Tubers and Bananas*

Submitted by:

CIP

Theme 6: Promoting postharvest technologies, value chains, and market opportunities

PRODUCT LINE 6.1.1: Postharvest approaches to improve food security: cross-cutting products				
Next users:	Knowledge transfer agents such as NGOs, CBOs, Community health workers, public and private sector, and breeders			
End users:	Poor households, both in the rural and urban areas including small and medium scale processors			
Expected impact:	Improved food and nutrition security and health			
Products	Milestones	Outcomes	Target region & key countries	Lead institution & key partners
6.1.1.1 Approaches to maximize nutritional quality	6.1.1.1.1 (2013) At least 5 genotypes of each of cassava, yam and banana with high contents of micronutrients and/or low anti-nutritional factors identified 6.1.1.1.2 (2012) At least 3 approaches to maximize nutritional qualities in RTB developed and tested 6.1.1.1.3 (2014) Tested approaches promoted to smallholder end users in SSA	Research: NARES and other stakeholders knowledge enhanced Development: utilization of identified nutrient enriched-genotypes by consumers; improved food and nutrition security	Sub-Saharan Africa (Nigeria, Ghana, Democratic Republic of the Congo, Malawi)	IITA, CIAT, NARIs and Universities in Africa
	6.1.1.1.4 (2013) At least 20 varieties of RTB screened for influence of drought and poor soil fertility on nutritional quality	Research: NARES and other stakeholders knowledge enhanced Development: utilization of identified drought tolerant genotypes by farmers; improved food and nutrition security	Sub-Saharan Africa (Nigeria, Ghana, Ivory Coast, Togo, Benin Republic)	IITA, CIAT, NARIs and Universities in Africa
6.1.1.2 Technologies to reduce anti-nutritional or toxic compounds	6.2.1.2.1 (2012) At least 3 process technologies used to reduce those contaminants (tannins, cyanogenic potential, and alkaloids) in RTB reported 6.2.1.2.2 (2014) Tested approaches shared and promoted with smallholder end users in target region & key countries	Research: knowledge of NARES and other stakeholders on technologies enhanced. Development: Improved food security	Sub-Saharan Africa (Nigeria, Ghana, Tanzania, Democratic Republic of the Congo, Malawi, Benin Republic, Tanzania, Madagascar, Zambia)	IITA, CIAT, MAFSC-Tanzania, TFNC, ZARI, FOFIFA
R&D PRODUCT LINE 6.1.2: Improving linkages to markets for environmentally friendly income generation activities: cross-cutting products				
Next users:	Private sector, food technologists, agro-processing industries			
End users:	Farmers, processors, consumers			
Expected impact:	Greater demand for RTB products and increased incomes			
Products	Milestones	Outcomes	Target region & key countries	Lead institution & key partners
6.1.2.1 New products to widen or facilitate smallholders access to markets and increase consumption	6.1.2.1.1 (2012) At least 3 industrial surveys conducted. 6.1.2.1.2 (2014) At least 2 adoption studies conducted 6.1.2.1.3 (2012) At least 2 reports on end users preference for RTB available 6.1.2.1.4 (2014) At least 10 Small and medium scale enterprises producing value added products	Research: NARES and other stakeholders knowledge enhanced. Development: Increased income and food security	Sub-Saharan Africa (Nigeria, Ghana, Sierra Leone, Tanzania, Malawi, Mozambique, Benin Republic, Rwanda, Burundi, Madagascar, Zambia)	IITA, CIAT, TFNC, ZARI, FOFIFA, FMOCI, VECO Benin, SLARI, Sierra Leone

	6.1.2.1.5 (2012) Participatory Market Chain Approach (PMCA) adapted and available for stimulating innovation with public and private partners around market opportunities for promoting consumption of improved potatoes and land races 6.1.2.1.6 (2013) Methods for stakeholder platforms organization to support innovation process, and promotion of market opportunities with gender equity for resource-poor farmers available	1) PMCA adapted by R&D organizations in x countries to varied socioeconomic and cultural conditions. 2) 10 outcome oriented projects using PMCA promote new market opportunities with better added value based on improved varieties and landraces 3). Public, private and farmer organizations interacting with research organizations to improve farmers' capacity to respond to new market opportunities using appropriate technologies.	Global	CIP, CIAT, IITA, Bioversity NGOs, CBOs, public-private partners
6.1.2.2 Starch quality and functional properties in relation to consumer (industry) preferences and needs	6.1.2.2.1 (2011) At least 50 genotypes of cassava and yam assessed 6.1.2.2.2 (2013) At least starch extracted and modified in 3 genotypes of cassava and yam	Research: NARES and other stakeholders knowledge enhanced. Development: Increased utilization of cassava starch by industries	Sub-Saharan Africa (Nigeria, Ghana, Malawi)	IITA, CIAT, Universities in Africa
6.1.2.3 Eco-efficient processing technologies including waste management	6.1.2.4.1 (2014) At least 4 technical feasibility and economic viability of different drying techniques conducted 6.1.2.4.2 (2014) Solar panel for drying adopted in at least 2 countries	Research: NARES and other stakeholders knowledge enhanced. Development: Improved product quality, income, and food security	Sub-Saharan Africa (Nigeria, Benin Republic, Sierra Leone, Ghana, Malawi, Tanzania, Madagascar, Zambia)	IITA, CIAT, MAFSC-Tanzania, TFNC, ZARI, FOFIFA, VECO Benin
R&D PRODUCT LINE 6.1.3: Marketing strategies and policies to promote RTB consumption: cross-cutting				
Next users:	CIP, IITA, Bioversity, CIAT, CLAYUCA, CIRAD, NARIs, NGOs, CBOs, public-private partners			
End users:	Farmers and public-private partners			
Expected impact:	New products with added value in the market benefit smallholders and greater consumption of RTB			
Products	Milestones	Outcomes	Target region & key countries	Lead institution & key partners
6.1.3.1 Marketing strategies to promote RTB consumption	6.1.3.1.1 (2014) At least 6 market channels for processed cassava, banana and yam identified 6.1.3.1.2 (2013) At least 10 Business plans developed	Research: Capacity of NARES to assess markets for RTB strengthened. Development: Profitable RTB based enterprises	Sub-Saharan Africa (Nigeria, Ghana, Sierra Leone, Tanzania, Malawi, Mozambique, Benin Republic, Rwanda, Burundi, Madagascar, Zambia)	IITA, CIAT, TFNC, ZARI, FOFIFA, FMOCI, VECO Benin, SLARI, Sierra Leone

6.1.3.2 Joint approaches to promote consumption of biofortified RTB	6.1.3.2.1 (2013) At least 10 Training of Trainers workshops organized in SSA 6.1.3.2.2 (2014) At least 100,000 farm families consuming biofortified RTB crops 6.1.3.2.3 (2014) Strategy for joint promotion of orange-fleshed sweetpotato and orange bananas in Uganda developed and financed. 6.1.3.2.4 (2014) Strategy for joint promotion of orange-fleshed cassava and orange-fleshed sweetpotato in Nigeria developed and financed	Research: Capacity of NARES and other stakeholders to disseminate technologies of RTB strengthened. Development: Improved health and food security The orange color due to beta-carotene in biofortified RTBs is clearly associated by at least half of the population with representing a very healthy food for all classes	Sub-Saharan Africa (Nigeria, Ghana, Sierra Leone, Tanzania, Malawi, Mozambique, Benin Republic, Rwanda, Burundi)	IITA, CIAT, nat partner 1, nat partner 2, University of Agriculture, Abeokuta, Nigeria
6.1.3.3 Social marketing approaches to facilitate small scale producers effective participation in the market chain (Linkage MP2)	6.1.3.3.3 (2014) At least 3 value chain sub-sector analysis conducted in RTB 6.1.3.3.7 (2014) At least 50 public-private partnership established	Research: NARES and other stakeholder's capacity enhanced. Development: Increased, effective and sustainable supply of raw material to industries Producers' market integration and willingness to increase production enhanced Increased income and job creation	Sub-Saharan Africa (Nigeria, Benin Republic, Sierra Leone, Ghana, Malawi, Tanzania, Madagascar, Zambia), LAC	IITA, CIAT, MAFSC-Tanzania, TFNC, ZARI, FOFIFA, FMOCI, VECO Benin, SLARI, Sierra Leone, NRCRI-Umudike, ADPs Federal College Universities, MATNA, EKHA-AGRO, NSM, MATNA, CIP
	6.1.3.3.8 (2013) Strategy and tools for promoting Corporate Social Responsibility (CSR), Good Agricultural Practices (GAP) and social inclusion (incl. gender) available to CGIAR centers 6.1.3.3.9 (2012) Diagnostic and checklist for fresh market chain governance from perspective of grower organization developed and tested.	1) Collaboration between agro-industries, R&D organizations and farmers organizations for facilitating small-scale farmers access to market. 2) CSR practices, GAP and principles for social inclusion within the market chain and smallholders' farming systems defined and promoted by R&I institutions and private sector.	Global	CIP, CIAT, IITA, Bioversity NGOs, CBOs, public-private partners
6.1.3.4 Equitable public – private partnerships (IPR issues, successful experiences, problems to avoid, etc.)	6.1.3.4.1 (2014) A system established to develop the income generating potential of RTB by capitalizing on the existing, but unexploited, and profitable market opportunities for cassava derivative products	Research: NARES, private sector, and other stakeholder's knowledge enhanced. Development: Higher income for RTB producers, processors, marketers and other stakeholders along the high quality RTB flour value chain	Sub-Saharan Africa (Nigeria, Benin Republic, Sierra Leone, Ghana, Malawi, Tanzania, Madagascar, Zambia)	IITA, CIAT, TFNC, ZARI, FOFIFA, FMOCI, VECO Benin, SLARI, Sierra Leone
	6.1.3.4.2 (2012) Methods for stakeholder platforms organization to support innovation process, and promotion of market opportunities with gender equity for resource-poor farmers available.	Public, private and farmer organizations interacting with research organizations to improve farmers' capacity to respond to new market opportunities using appropriate technologies.	Global	CIP, CIAT, IITA, Bioversity NGOs, CBOs, public-private partners
6.1.3.5 Group marketing strategies	6.1.3.5.1 (2014) Potential consequences of standardization of RTB within the context of opportunity for market access assessed.	Research: NARES, private sector, and other stakeholder's knowledge enhanced. Development: Higher income for RTB producers, processors, marketers and other stakeholders along the high quality RTB flour value chain	Sub-Saharan Africa (Kenya, Tanzania, Rwanda, Burundi, Democratic Republic Congo)	IITA, CIAT, nat partner 1, nat partner 2, FMOCI, VECO Benin, SLARI, Sierra Leone

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PRODUCT LINE 6.2.1: Postharvest approaches to improve food security: bananas and plantain				
Next users:	Development organization, National Agricultural Extension Service, Private Sector Business person, NGO, community health and nutrition workers			
End users:	Farmer Organization, Community enterprises, Business Support providers, micro-business food processors, housewives			
Expected impact:	Improved quality of banana based diets to cover Vitamin A and carotenoid shortfalls based on the use of the diversity of banana cultivars and processing			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners
6.2.1.1 Approaches to maximize nutritional quality	6.2.1.1.1 (2011) Analysis of provitamin A Carotenoids (pVACs) in Musa varieties during ripening and different processing 6.2.1.1.2 (2012) Bioavailability of (pVACs) from Musa based products and product characteristics for optimum nutritional quality 6.2.1.1.3 (2013) Evaluate diversity of key nutritional compounds claimed to have impact on human health (resistant starch, Potassium, flavonoids).	1) Diversified processing options promoted for optimal retention of nutritional quality 2) Intra crop diversity used for improving nutritional qualities of bananas as staple food	Global	Bioversity, CIAT, IITA, CIALCA consortium, CIRAD, KUL Leuven
6.2.1.1 Diversified processing options to enhance banana consumption and food security	6.3.1.3.1 (2013) At least 5 new or existing processing methods for banana developed, improved, tested and/or promoted. 6.3.1.3.2 (2013) At least 2 appropriate machinery for processing banana developed, tested and disseminated.	Research: NARES and other stakeholders knowledge enhanced. Development: Increased consumption of cassava products. Stronger markets for cassava. Improved income of cassava households.	Global	CIAT, Espol, INIAP, IITA
PRODUCT LINE 6.2.2: Improving linkages to markets for environmentally friendly income generation activities: bananas and plantain				
Next users:	IITA, CIRAD and CIAT, NARIs, NGOs, private sector			
End users:	Value chain actors including farmers, processors and the animal feed, starch, ethanol and food processing industries.			
Expected impact:	Enhanced income and livelihoods in banana growing and consuming communities			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners
6.2.2.1 Banana functional properties in relation to consumer (industry) preferences	6.2.2.1 (2011) Evaluate germplasm collection from around the world for flour quality properties. 6.2.2.2 (2013) Correlate consumer preferences with functional properties of cultivated varieties. 6.2.2.3 (2013) Key environmental parameters that influence fruit quality in relation to consumer preferences (GxE).	Research: NARES and other stakeholders knowledge enhanced. Development: Increased utilization of different banana genotypes by industries	Global	CIAT, CIRAD, IITA, Local Universities, NARS, Public sector

6.2.2.2 Eco-efficient processing technologies for human consumption	6.2.2.2.1 (2014) At least 4 technical feasibility and economic viability of different processing techniques conducted 6.2.2.2.2 (2014) Technology for conversion of banana processing wastes into products for use as animal feed, fertilizer and densified fuel pellets, developed, tested and disseminated	Research: NARES and other stakeholders knowledge enhanced. Development: Improved product quality, income, and food security. Increased dissemination of improved technologies that benefit farmers. Benchmarking between LAC and Africa.	LA, Africa	CIAT, CIRAD, IITA, Local Universities, NARS, Public sector
6.2.2.3 Technologies for banana and plantain fermentation for commercial purposes.	6.2.2.3.1 (2013) Sustainable, competitive, affordable processing technology to produce bioenergy from banana waste, developed, tested and disseminated 6.2.2.3.2 (2013) Distillation optimization to combine processing technologies with different raw material characteristics 6.2.2.3.3 (2012) Analysis of carbon footprint of biofuels systems based on banana	Research: Optimized processing technologies for bioethanol production from banana. Organizational approaches for decentralized production of ethanol. Development: Stronger markets for banana. Reduced dependency on fossil fuels for energy in isolated regions of the world.	Africa, LA	CIAT, CIRAD, Local Universities, NARS, Public sector
6.2.2.4 Technologies for use of banana waste and discard for animal feeding	6.3.2.6.1. (2012) Consolidation of information for on-farm animal feeding (swine, goat, chicken, fish and cattle), based on banana and banana waste. 6.3.2.6.2 (2014) Assessment of protein digestibility and anti-nutritional factors of banana discard to formulate feedstock 6.3.2.6.3 (2015) Dissemination of on-farm, banana-based animal feeding systems suitable to at least three different countries per continent.	Research: Basic knowledge on nutritional contributions of banana product (fruit stem and/or waste) in different formulations. Development: Enhanced food security. Value addition on-farm. Enhanced income of banana households.	LA	CIAT, CIRAD, Local Universities, NARS, Public sector
6.3.2.8. Reverse-engineered analysis of consumer preferences for market targeted product development	6.3.2.8.1 (2013) Detailed processing flowsheet for traditional banana recipes. 6.3.2.8.2 (2014) Identification of bottlenecks to improve competitiveness and reduce environmental impact of processing technologies. 2.3.2.8.3 (2014) Characterization of quality (genotype/ process/genotype) attributes to maximize efficiency and quality in relation to consumer preferences.	Research: Definition of preferences of consumers. Enhanced processing technologies. Development: improved income in value-addition chain. Better quality products lead to enhanced public health and stronger markets for banana.	Global	CIAT, CIRAD, IITA, Local Universities, NARS, Public sector
PRODUCT LINE 6.2.3: Marketing strategies and policies to promote RTB consumption: bananas				
Next users:	Development organization, National Agricultural Extension Service, Private Sector Business person, NGO			
End users:	Farmer Organization, Community enterprises, Business Support providers			
Expected impact:	Greater value added captured by rural communities through processing and marketing of commodity crop biodiversity			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners

6.2.3.1 Social marketing approaches to facilitate small scale producers effective participation in the market chain (Linkage MP2)	6.2.3.1.1 (2012) Diagnostic and checklist for fresh market chain governance from perspective of grower organization developed and tested	1) Banana grower organizations improve their participation in market chains in Sudan and Ethiopia based on diagnostic and marketing information website. Improved rural development projects for supporting grower organizations for adding value to commodity crops and for conserving commodity biodiversity in situ	Ethiopia and Sudan, Latin America and Caribbean, Burundi, Rwanda	Bioversity International, IITA, UNAN Leon, Nicaragua, INIA Peru, IHCAFE Honduras, University of Costa Rica, NARO Uganda
6.2.3.2 Group marketing strategies	6.2.3.2.1 (2013) Methods developed for strengthening farmer organizations to start up and manage processing and marketing businesses to conserve Musa biodiversity and add value to new cultivars	1) Farmer groups improving value chain participation of bananas from agroforestry systems based on identified niche markets in 9 pilot zones in LAC and ESA; 2) Improved rural development projects for adding value to commodity crops and for conserving commodity biodiversity in situ through marketing strategies developed	Latin America, Caribbean, East Africa	Bioversity International, IITA, UNAN Leon, Nicaragua, INIA Peru, IHCAFE Honduras, University of Costa Rica, NARO Uganda

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PRODUCT LINE 6.3.1: Postharvest approaches to improve food security: cassava				
Next users:	IITA and CIAT, NARIs, NGOs, Food Security related organizations. Public health authorities.			
End users:	Rural and urban resource poor households in food insecure countries			
Expected impact:	Enhanced food security through safer products with enhanced shelf life.			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners
6.3.1.1 Approaches to reduce post-harvest physiological deterioration (PPD) of storage roots, increase shelf life, reduce post-harvest losses and enhance marketability of roots.	6.3.1.1.1. (2014) At least 3 different post-harvest processing approaches evaluated in tolerant and susceptible cassava genotypes. 6.3.1.1.2. (2015) Identification of genotype-by-post-harvest handling interaction on shelf life of cassava roots. 6.3.1.1.3. (2015) Further knowledge on the biochemical pathway (enzymes) leading to PPD.	Research: a. Better understanding of factors affecting shelf life of cassava roots. b. Guidelines for efficient post-harvest handling of cassava roots. c. Capacity of NARES to conduct and extend knowledge on PPD, losses, and quality is increased. Development: NARES recommendations on reduction of postharvest losses	Global	IITA, CIAT, CLAYUCA, NARs in Africa, Asia and LAC
6.3.1.2 Technologies to reduce anti-nutritional or toxic compounds	6.3.1.2.1 (2012) Key contaminants and critical control points for contamination identified 6.3.1.2.2 (2014) Key microbial contamination in cassava foods produced by at least five traditional and improved processing methods investigated 6.3.1.2.3 (2014) Various management methods tested for minimizing contamination in cassava 6.3.1.2.4 (2012) Processing technologies to reduce toxicant compounds in cassava products (including leaves), developed, tested and disseminated.	Research: a. Basic knowledge on contaminants and toxicants in cassava products from leaves and roots. b. Capacity of NARES, Public Health authorities and other stakeholders enhanced. Development: NARES recommendations for improving food safety.	Africa and LAC. Some Asian countries.	IITA, CIAT, TFNC, ZARI, FOFIFA, IIAM, Univ of Agric Abeokuta, Nigeria. AGROSALUD. Colombia, Brazil. Public health authorities.
6.3.1.3 Diversified processing options to enhance cassava consumption and food security	6.3.1.3.1 (2013) At least 5 new or existing processing methods for cassava roots and leaves developed, improved, tested and/or promoted. 6.3.1.3.2 (2013) At least 4 appropriate machinery for processing cassava roots and leaves developed, tested and disseminated.	Research: NARES and other stakeholders knowledge on cassava processing options enhanced. Development: Diverse options for processing promoted by NARES.	Global	IITA, CIAT, TFNC, Univ of Agric Abeokuta, FMOCI, VECO Benin, SLARI, Sierra Leone. CLAYUCA, McCain, FRITOLAY, Corn Products Andina
PRODUCT LINE 6.3.2: Improving linkages to markets for environmentally friendly income generation activities: cassava				
Next users:	IITA, CIRAD, CLAYUCA and CIAT, NARIs, NGOs, private sector			
End users:	Value chain actors including farmers, processors and the animal feed, starch, ethanol and food processing industries.			
Expected impact:	Enhanced income and livelihoods in cassava growing and consuming communities			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners

6.3.2.1 Knowledge on starch quality and functional properties in relation to consumer (industry) preferences and needs in Africa	6.3.2.1.1 (2011) At least 50 genotypes assessed 6.3.2.1.2 (2013) Starch extracted and modified from at least 3 genotypes	Research: NARES and other stakeholders knowledge enhanced. Development: Increased utilization of cassava starch by industries	Sub-Saharan Africa (Nigeria, Ghana, Malawi)	IITA, Universities in Africa
6.3.2.2 Eco-efficient processing technologies including waste management	6.3.2.2.1 (2014) At least 4 technical feasibility and economic viability of different drying techniques conducted 6.3.2.2.2 (2014). Wind energy system for drying cassava roots,leaves and peels, developed, tested and disseminated 6.3.2.2.3 (2014) Solar panel drying system for cassava roots, leaves and peels,developed, tested and disseminated 6.3.2.3.4 (2014) Technology for conversion of cassava processing wastes into products for use as animal feed, fertilizer and densified fuel pellets, developed, tested and disseminated	Research: NARES and other stakeholders knowledge enhanced. Development: Improved product quality, income, and food security. Increased dissemination of improved technologies that benefit farmers	Global	IITA, CLAYUCA, CIAT, CIRAD, NRI,Universidad Federal Rio Grande do Sul-Brazil, CERAT-Brazil,EMBRAPA-Brazil.MAFSC-Tanzania, TFNC, ZARI, FOFIFA,VECO Benin
6.3.2.3 Technologies for bio-ethanol production and organizational issues for decentralized operations	6.3.1.3.1 (2013) Sustainable, competitive, affordable processing technology to produce ethanol from cassava fresh roots, dry chips and refined flour, developed, tested and disseminated 6.3.2.3.2 (2013) Distillation optimization to combine processing technologies with different raw material characteristics (amylose free, small starch granule, and sugary cassava roots). 6.3.2.3.3. (2015) Local uses of cassava ethanol for bio-electricity, cooking and transportation, validated and promoted in small-scale rural communities that are totally dependent on fossil fuels.	Research: Optimized processing technologies for bioethanol production from cassava. Organizational approaches for decentralized production of ethanol. Development: Stronger markets for cassava. Reduced dependency on fossil fuels for energy in isolated regions of the world.	Global	CLAYUCA, CIRAD, CIAT, NRI,Universidad Federal Rio Grande do Sul-Brazil, CERAT-Brazil,EMBRAPA-Brazil.
6.3.2.4 Technologies to take advantage of the recently discovered amylose-free, high-amylose and sugary starch mutations.	6.3.2.4.1 (2013) Identification of the main uses of these valuable root quality mutants. 6.3.2.4.2 (2015) Definition of at least three commercial products where these root quality mutants offer competitive advantages.	Research: Better understanding of the potential of the starch mutations for new food and non-food products. Development: Stronger markets for cassava products. Stronger value addition chains for cassava products.	Global	CIAT, CIRAD, CLAYUCA

6.3.2.5. Technologies for industrial production of animal feed based on roots and/or foliage	6.3.2.5.1 (2013) Technology for the harvest and drying of cassava foliage. 6.3.2.5.2. (2014) New formulations of balanced feed based on dried cassava products (roots, foliage and /or waste) for animals (including pets).	Research: Basic knowledge on nutritional contributions of cassava products (roots, foliage and/or waste) in different formulations. Development: Better cassava-based feed formulations promoted	Global	CLAYUCA, CIAT, IITA, ILRI, CIRAD, NARIs from Asia, LAC and Africa
6.3.2.6 Technologies for improved animal feeding.	6.3.2.6.1. (2012) Consolidation of information for on-farm animal feeding (swine, goat, chicken, fish and cattle), based on cassava roots and leaves (fresh, dried, silage). 6.3.2.6.2 (2014) Assessment of protein digestibility from cassava leaves. 6.3.2.6.3 (2015) Dissemination of on-farm, cassava-based animal feeding systems suitable to at least three different countries per continent	Research: Basic knowledge on nutritional contributions of cassava product (roots, foliage and/or waste) in different formulations. Development: Recommendations for better cassava-based animal feeding	Global	CLAYUCA, IITA, CIAT, ILRI, CIRAD, NRI, Universidad Federal Rio Grande do Sul-Brazil, CERAT-Brazil, EMBRAPA-Brazil, MAFSC-Tanzania, TFNC, ZARI, FOFIFA, VECO Benin
6.3.2.7 Efficient protocols for water and waste management in small and medium-scale processing factories	6.3.2.7.1 (2012) Technologies to reduce water consumption developed, tested and disseminated (dry starch extraction process). 6.3.2.7.2 (2012) Technologies for incorporation of wastes (solid and liquid) from cassava processing operations into products for animal feeding (connection to product line 6.3.2.2) 6.3.2.7.3 (2014) Life cycle analysis in cassava processing operations to maximize efficiencies and reduce environmental impacts.	Research: Better, ecofriendly technologies for starch production (cottage scale). Development: Protection of the environment of cassava producing regions of the world.	Global	CLAYUCA, IITA, CIAT, CIRAD, NRI, Universidad Federal Rio Grande do Sul-Brazil, CERAT-Brazil, EMBRAPA-Brazil, MAFSC-Tanzania, TFNC, ZARI, FOFIFA, VECO Benin
R&D PRODUCT LINE 6.1.3: Marketing strategies and policies to promote RTB consumption				
Next users:	Synergies between IITA, CIAT, CLAYUCA, and CIRAD. NARIs, NGOs, CBOs, public-private partners			
End users:	Farmers and public-private partners			
Expected impact:	New products with added value in the market benefit smallholders and greater consumption of RTB			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners

6.3.3.1 Effective collective action strategies designed to support the integration of small scale producer organizations into profitable market chains. (Linkage MP2)	6.3.3.1.3 (2012) At least 3 value chain sub-sector analysis conducted in cassava 6.3.3.1.5 (2013) Effective market linkages for at least 3 partners facilitated 6.3.3.1.7 (2014) At least 25 public-private partnership established. 6.3.3.8 (2014) Identification of bottlenecks or areas for potential improvements for value addition	Research: NARES and other stakeholder's capacity enhanced. Development: Increased, effective and sustainable supply of raw material to industries Producers' market integration and willingness to increase production enhanced. Equitable public – private partnerships (IPR issues, successful experiences, problems to avoid, etc.)	Global	IITA, CIAT, CLAYUCA, NGOs, private sector, MAFSC-Tanzania, TFNC, ZARI, FOFIFA, FMOCI, VECO Benin, SLARI, Sierra Leone, NRCRI-Umudike, ADPs Federal College Universities, MATNA, EKHA-AGRO, NSM, MATNA
6.3.3.2 Production of quality standards for food products advocated and facilitated. (Linkage MP2)	6.3.3.3.1 (2014) Potential consequences of standardization of cassava products within the context of opportunity for market access assessed	Research: NARES, private sector, and other stakeholder's knowledge enhanced. Development: Improved marketing of cassava products	Sub-Saharan Africa (Kenya, Tanzania, Rwanda, Burundi, Democratic Republic Congo)	IITA, CIAT, nat partner 1, nat partner 2, FMOCI, VECO Benin, SLARI, Sierra Leone
6.3.2.8. Reverse-engineered analysis of preferences along the value chain actors.	6.3.2.8.1 (2014) Optimization of processing/genotype interactions to maximize efficiency and quality in relation to consumer preferences.	Research: Definition of preferences of consumers. Enhanced processing technologies. Development: Better quality products lead to enhanced public health and stronger markets for cassava.	Global with emphasis in Africa and LAC	IITA, CIRAD, CIAT, CLAYUCA and NARIs in key target countries and key processing industries.

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PRODUCT LINE 6.4.1: Postharvest approaches to improve food security: potato				
Next users:	NARIs, NGOs, Food Security related organizations			
End users:	Small households in vulnerable territories			
Expected impact:	XX%* of households attended by the project improve their food security (increase in production and/or access to food and/or quality of food) and			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners
6.4.1.1 Approaches to maximize nutritional quality	6.4.1.1.1 (2011) Existing or new baselines developed to establish the local food and production systems and the role of potato in these systems. 6.4.1.1.2 (2012) Research on crop management and postharvest systems, potato biodiversity, and nutrition considering a gender approach. 6.4.1.1.3 (2013) Studies on the role of potato biodiversity in the diets of local populations; qualitative and quantitative analysis 6.4.1.1.4 (2014) Studies on the effect of potato biodiversity on nutrition of local populations; qualitative and quantitative analysis. 6.4.1.1.5 (2013) Explore potato germplasm (native varieties) to identify physiological and nutritional traits of interest	1) Partners from NARS are using adapted methodologies and work in multidisciplinary teams to implement studies on food and production systems. 2) CIP and NARS partners trained on methodologies to evaluate nutritional qualities and able to apply efficient methodologies to evaluate diets of local population. 3) New production, postharvest and processing technologies/practices are implemented to preserve nutritional attributes of potatoes, and to improve access to market opportunities.	LAC, SSA, SWCA	CIP, NARIs, NGOs,
PRODUCT LINE 6.4.2: Improving linkages to markets for environmentally friendly income generation activities: potato				
Next users:	CIP, NGOs, CBOs, public-private partners			
End users:	Farmers			
Expected impact:	XX%* of households attended by the project improve their income (linked to performance, quality and price) through the incorporation of innovations.			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners
PRODUCT LINE 6.4.3: Marketing strategies and policies to promote RTB consumption: potato				
Next users:	CIP, NARIs, NGOs, CBOs, public-private partners			
End users:	Farmers and public-private partners			
Expected impact:	XX%* of households attended by the project improve their linkage with new market opportunities and new products			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners

Theme 6: Promoting postharvest technologies, value chains, and market opportunities

PRODUCT LINE 6.5.1: Postharvest approaches to improve food security: sweetpotato

Next users:	CIP, NARIs, NGOs, Food Security related organizations			
End users:	Rural and urban resource poor households in food insecure countries			
Expected impact:	XX%* of households attended by the project improve their food security (increase in production and/or access to food and/or quality of food) and			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners
6.5.1.1 Approaches to enhance shelf-life of fresh root, semi-processed and processed sweetpotato	6.5.1.1.1 At least two approaches for enhancing the shelf-life of fresh sweetpotato roots developed and and shelf life of over 200 genotypes evaluated 6.5.1.1.2 One economically viable method for storing orange-fleshed sweetpotato puree developed and validated by 2013 6.5.1.1.3 At least one improved technique for village level storage of dried chips developed and validated by 2013	Collaboration among ARIs and R&D organisations to adapt technologies for low income country context; New production, postharvest and processing technologies/practices are implemented to preserve nutritional attributes of OFSP, and to improve access to market opportunities.	SSA (Rwanda, Kenya, Malawi),	ARIs, NARS, Bureaus of Standards
6.5.1.2 Technologies to reduce anti-nutritional or toxic compounds	6.5.1.2.1 Appropriate sweetpotato-based silage for dairy cattle and pigs demonstrates reduced levels of trypsin inhibitor by 2012	Dairy farmers report higher milk output from cows utilizing silage.	SSA (Kenya, Rwanda)	CIP, University of Nairobi, Heifer International, ILRI
6.5.1.3 Approaches to maximize nutritional quality	6.5.1.3.1 B-Carotene, zinc and iron degradation in stored fresh roots, semi-processed and processed products evaluated; 6.5.1.3.2 At least one technology to enhance b-carotene retention in semi-processed or processed products developed and validated.	Bureau of standards and agro-processors are cognizant of rates of beta-carotene degradation under different conditions and how to minimize the problem	SSA (Kenya, Rwanda)	ARIs, NARS, Bureaus of Standards
6.5.1.4 Diversified processing options to enhance SP consumption and food security	6.5.1.4.1 Market chains for at least 6 sweetpotato-based processed products developed by 2013; 6.5.1.4.2 Assessment of at least 2 chains with formal sector agro-processing partners and determination of potential for going-to-scale by 2013	Male and female farmers increase revenues 15 percent after linked with sweetpotato market chains	SSA (Rwanda, Malawi)	NARS, private sector processors (SINA, Universal Industries)

PRODUCT LINE 6.5.2: Improving linkages to markets for environmentally friendly income generation activities: sweetpotato

Next users:	CIP, NGOs, CBOs, public-private partners			
End users:	Farmers and rural and urban consumers			
Expected impact:	XX%* of households attended by the project improve their income (linked to performance, quality and price) through the incorporation of innovations.			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners

6.5.2.1 New products to widen or facilitate smallholders access to markets and increase consumption	6.5.2.1.1 At least four sweetpotato based processed product, based on substituting 20-50% of wheat flour with sweetpotato puree or flour by 2013	Income generating opportunities especially for women. through diversification of OFSP processed products.	SSA (Rwanda, Malawi)	CIP, NGOs, NARIs, CBOs, public-private partners, agro-industry
6.5.2.2 Functional properties of sweetpotato flour understood	6.5.2.2.1 Non-sweet sweetpotato flour developed and tested for acceptability for use in at least 4 traditional West Africa foods by 2013 6.5.2.2.2 Ideal varieties in terms of use as flour for commercial biscuit production identified and validated by 2013	1. Non-sweet sweetpotato recognized as a viable alternative to cassava or yam in several traditional West African processed products 2. Major agroprocessor producing biscuits with at least 20% sweetpotato flour content sold nationwide	SSA (Nigeria (1) Malawi (2))	CIP, NARIs, Universal Industry (private sector)
6.5.2.3 Eco-efficient processing technologies including waste management	6.5.2.3.1 At least two solar and/or wind powered systems developed and validated for sweetpotato processing activities by 2013 6.5.2.3.2 At least one viable strategy for managing waste from sweetpotato processing adopted by private sector operators by 2013	Medium-scale sweetpotato processors know how to access and utilize eco-efficient processing technologies	SSA (Rwanda, Malawi)	CIP, NARIs, private sector
6.5.2.4 Animal Feed	6.5.2.4.1 At least 3 economically viable silage recipes combining sweetpotato vines & roots with other local ingredients by 2013	Dairy and pig farmers have access to previously unavailable nutritious source of dry season feed; 30% of targeted farmers have adopted recommended dual purpose sweetpotato varieties	SSA (Kenya, Rwanda)	CIP, Heifer International (NGO), Farmer's Choice (private sector), NARIs (Kenya/Rwanda), ILRI

PRODUCT LINE 6.5.3: Marketing strategies and policies to promote RTB consumption: sweetpotato+A10

Next users:				
End users:				
Expected impact:				
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners
6.5.3.1 Marketing strategies and policies to promote SP consumption	6.5.3.1.1 Assessment in at least 2 countries of financial returns to sweetpotato producers engaged in formal vs. informal value chains and equity trade-offs by 2013; 6.5.3.1.2 Development and testing in at least five countries of strategies for stimulating demand of urban consumers by gender for sweetpotato roots and products by 2013	Producers' incomes increase 15 percent due to market chain development; consumers increase sweetpotato intake 30% through processed product consumption; Urban men and women exposed to campaign to increase consumption of sweetpotato by 30 percent per year	SSA (Value chains: Rwanda, Malawi; Demand creation: Rwanda, Malawi, Tanzania, Mozambique, Uganda, Ghana)	NARS, NGOs, Policy makers

6.5.3.2 An Orange Brand firmly established for promoting orange-flesh sweetpotato roots and processed products	6.5.3.2.1 Consumer surveys in at least 3 countries confirm perception that orange-fleshed sweetpotato roots and processed products are particularly good for improving one's health by 2013	Widespread awareness that consumption of pro-vitamin rich foods is good for one's health and OFSP is an excellent source of pro-vitamin A	SSA (Kenya, Uganda, Rwanda, Tanzania, Mozambique, Malawi, Ethiopia, Ghana, Nigeria)	CIP, NARS, NGOs, private sector
6.5.3.3 Pro-RTB government policies	6.5.3.3.1 Specific policy documents in at least 3 countries acknowledge the critical role RTB play in addressing food insecurity and malnutrition and government resources allocated to sweetpotato increased by at least 10% by 2013	Policy makers are advocates within their own country for expanding and diversifying the use of sweetpotato	SSA (Mozambique, Malawi, Rwanda, Ghana, Uganda)	CIP, HarvestPlus, NARS, farmer advocacy organizations
6.5.3.4 Social marketing approaches to facilitate small scale producers effective participation in the market chain (Linkage MP2)	6.5.3.4.1 At least 8 social marketing campaigns designed and implement to promote use of nutritionally enhanced sweetpotato fresh roots & products among producers & consumers by 2013 6.5.3.4.2 At least 10,000 farmers mobilized and linked to agro-processed product markets by 2013	Evidence of how cost-effectively link farmers to sweetpotato product markets established and manuals for guiding the process readily available	SSA (Rwanda, Malawi, Mozambique)	CIP, NARIs, private sector
	6.5.3.4.3 Delivery systems that benefit the poor, especially women and children that 1) combat vitamin A and other nutritional deficiencies and 2) generate cash available by 2013; 6.5.3.4.4 Determination of cost-effectiveness of delivery system based on integrated health and agricultural system based on integrated health and agricultural interventions that promote OFSP and two additional OFSP-based models by 2013	At least 60 percent of women of reproductive age and children under 5 years of age have improved vitamin A intake and absorption; women are empowered through improved knowledge concerning nutrition and health practices	SSA	CIP, NGOs, NARIs, CBOs, Health sector, media
6.5.3.5 Equitable public – private partnerships (IPR issues, successful experiences, problems to avoid, etc.)	6.5.3.5.1 Documentation of both successful and problematic experiences establishing public-private sector partnerships, with particular emphasis on how to maximize benefits for women by 2013 6.5.3.5.2 (2012) Methods for stakeholder platforms organization to support innovation process, and promotion of market opportunities with gender equity for resource-poor farmers available by 2013	1) Guidelines on successful public-private partnership for sweetpotato-based products available on the internet. 2) Public, private and farmer organizations interacting with research organizations to improve farmers' capacity to respond to new market opportunities using appropriate technologies.	SSA	CIP, NARIs, private sector; CBOs, public-private partners; NGO

Theme 6: Promoting postharvest technologies, value chains, and market opportunities

PRODUCT LINE 6.6.1: Postharvest approaches to improve food security: yams+A10				
Next users:	IITA, NARIs, NGOs, CBOs, Food Security related organizations. Public health authorities.			
End users:	Rural and urban resource poor households in food insecure countries			
Expected impact:	Enhanced food security through safer products with enhanced shelf life.			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners
6.6.1.1 Approaches to enhance shelf-life of RTB: post-harvest losses reduced by minimizing tuber rots	(2014) Fungicides, biocontrol agents, and plant extracts evaluated for reduction of tuber rots in yams (2013) At least two improved drying technologies developed and available (2013) At least 3 appropriate packaging materials and methods evaluated and promoted for RTB crops	Research: Capacity of NARES to evaluate and extend improved rot management strategies is increased. Development: Food security Income of yam growers increased	West Africa/Nigeria	IITA, NGOs, CBOs, NARS
6.6.1.2 Approaches to maximize nutritional and medicinal qualities	(2013) At least 5 genotypes of yam with high contents of provitamin A and dioscin and low anti-nutritional factors identified (2012) At least 3 approaches to maximize nutritional qualities in yams developed and tested (2014) Tested approaches promoted to smallholder end users in SSA. (2013) At least 20 varieties of yams assessed for influence of drought and poor soil fertility on nutritional quality	Research: NARES and other stakeholders knowledge enhanced Development: utilization of identified nutrient enriched-genotypes by consumers; improved food and nutrition security; utilization of identified drought tolerant genotypes by farmers.	West Africa/Nigeria, Ghana, Ivory Coast, Togo, Benin Republic	IITA, NGOs, CBOs, NARS
6.1.1.2 Technologies to reduce anti-nutritional or toxic compounds	(2012) At least 3 process technologies used to reduce those contaminants (tannins and alkaloids) in yams reported (2014) Tested approaches shared and promoted with smallholder end users in target region & key countries	Research: knowledge of NARES and other stakeholders on technologies enhanced. Development: Improved food security	Sub-Saharan Africa	IITA, NGOs, CBOs, NARS
PRODUCT LINE 6.6.2: Improving linkages to markets for environmentally friendly income generation activities: yams				
Next users:	IITA, NARIs, NGOs, private sector			
End users:	Value chain actors including farmers, processors and traders			
Expected impact:	Enhanced income and livelihoods in yam growing and consuming communities			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners

6.1.2.1 New products to widen or facilitate smallholders access to markets and increase consumption	(2012) At least 3 industrial surveys conducted. (2014) At least 2 adoption studies conducted (2012) At least 2 reports on end users preference for RTB available (2014) At least 10 Small and medium scale enterprises producing value added products	Research: NARES and other stakeholders knowledge enhanced. Development: Increased income and food security	Sub-Saharan Africa	IITA, NGOs, CBOs, NARS
6.1.2.2 Approaches designed for effective linkages between value chain actors	(2012) Participatory Market Chain Approach (PMCA) adapted and available for stimulating innovation with public and private partners around market opportunities for promoting consumption of yams (2013) Methods for stakeholder platforms organization to support innovation process, and promotion of market opportunities with gender equity for resource-poor farmers available	Research: NARES and other stakeholders knowledge enhanced. Development: Public, private and farmer organizations interacting with research organizations to improve farmers' capacity to respond to new market opportunities using appropriate technologies.	Sub-Saharan Africa	IITA, NGOs, CBOs, NARS
6.1.2.3 Yam flour quality and functional properties in relation to consumer (industry) preferences and needs	(2012) At least 50 genotypes of yam assessed	Research: NARES and other stakeholders knowledge enhanced. Development: Increased utilization of yam flour by industries	Sub-Saharan Africa	IITA, NGOs, CBOs, NARS
6.1.2.4 Eco-efficient processing technologies including waste management	(2014) At least 4 technical feasibility and economic viability of different drying techniques conducted (2014) Drying technologies promoted in at least 2 countries	Research: NARES and other stakeholders knowledge enhanced. Development: Improved product quality, income, and food security	Sub-Saharan Africa	IITA, NGOs, CBOs, NARS
PRODUCT LINE 6.6.3: Marketing strategies and policies to promote RTB consumption: yams				
Next users:	IITA, CIRAD, NARIs, NGOs, CBOs, public-private partners			
End users:	Farmers, marketers, consumers			
Expected impact:	Increased consumption of yams			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners
6.1.3.1 Marketing strategies to promote RTB consumption	(2014) At least 4 market channels for processed yam identified (2013) At least 8 business plans developed	Research: Capacity of NARES to assess markets for yams strengthened. Development: Profitable yam based enterprises	Sub-Saharan Africa	IITA, NGOs, CBOs, NARS
6.1.3.3 Social marketing approaches to facilitate participation of smallholder producers in the market chain	(2014) At least 3 value chain sub-sector analysis conducted for yams	Research: NARES and other stakeholder's capacity enhanced. Development: Increased, effective and sustainable supply of raw material to yam flour industry Producers' market integration and willingness to increase production enhanced	Sub-Saharan Africa	IITA, NGOs, CBOs, NARS

Theme 6: Promoting postharvest technologies, value chains, and market opportunities

PRODUCT LINE 6.7.1: Postharvest approaches to improve food security: other RTB				
Next users:	NARIs, NGOs, Food Security related organizations			
End users:	Small households in vulnerable territories			
Expected impact:	XX%* of households attended by the project improve their food security (increase in production and/or access to food and/or quality of food) and			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners
6.7.1.1 Approaches to maximize nutritional quality of Andean root and tuber (ART) crops	6.7.1.1.1 (2014) Studies on the effect of ART biodiversity on nutrition and health of local populations combined with ethnobotany; qualitative and quantitative analysis.	3) New production, postharvest and processing technologies/practices are implemented to preserve nutritional attributes of ART, and to improve and dynamize access to market opportunities	LAC	CIP, Andean NARIs, NGOs,
6.7.1.2 Diversified processing options to enhance yam bean consumption and food security	6.7.1.2.1 (2011) Protein and micronutrient levels after processing yam bean storage roots is determined; 6.7.1.2.2 (2012) Yam bean based products are developed and tested for acceptability for use; 6.7.1.2.3 (2013) Composite products SP/yam bean are developed and tested for acceptability for use; 6.7.1.2.4 (2014) Private sector adopts yam bean as one input into the food industry in one SSA country	New products available for use by stakeholders	SSA (Benin, Uganda, Rwanda, Burundi, Congo, Ghana)	CIP, NGOs, NARIs, CBOs, public-private partners
PRODUCT LINE 6.7.2: Improving linkages to markets for environmentally friendly income generation activities: other RTB				
Next users:	CIP, NGOs, CBOs, public-private partners			
End users:	Farmers			
Expected impact:	XX%* of households attended by the project improve their income (linked to performance, quality and price) through the incorporation of innovations.			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners
6.7.2.1 New products to widen or facilitate smallholders access to markets and increase consumption of yam bean in SSA	6.7.2.2.1 (2014) New methods for stakeholder platforms organization to support innovation process, and promotion of market opportunities with gender equity for resource-poor farmers available.	Public, private and farmer organizations interacting with research organizations to improve farmers' capacity to respond to new market opportunities using appropriate technologies	SSA (Benin, Uganda, Rwanda, Burundi, Congo, Ghana)	CIP, NGOs, NARIs, CBOs, public-private partners
PRODUCT LINE 6.7.3: Marketing strategies and policies to promote RTB consumption				
Next users:	CIP, NARIs, NGOs, CBOs, public-private partners			
End users:	Farmers and public-private partners			
Expected impact:	XX%* of households attended by the project improve their linkage with new market opportunities and new products			
Products	Milestones	Outcomes	Target region and key countries	Lead institution and key partners

6.7.3.1 Marketing strategies and policies to promote yam bean consumption	6.7.3.2.1 (2011) Baseline study establishes the role of R&T in the local food and production systems and the potential role of yam bean in these systems; 6.7.3.2.2 (2013) Participatory Market Chain Approach (PMCA) adapted and available for stimulating innovation with public and private partners around market opportunities for promoting consumption of yam bean in SSA	Partners from NARS are using adapted methodologies and work in multidisciplinary teams to implement studies on food and production systems	SSA (Benin, Uganda, Rwanda, Burundi, Congo, Ghana)	CIP, NGOs, NARIs, CBOs, public-private partners
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