ROOTS TUBERS & BANANAS

RTB PERFORMANCE MONITORING REPORT FOR 2016

APRIL 2017

CGIAR RESEARCH PROGRAM ON Roots, Tubers and Bananas

LED BY CIP INTERNATIONAL POTATO CENTER

Bioversity International

CIAT Centro Internacional de Agricultura Tropical International Center for Tropical Agriculture

cirad AGRICULTURAL RESEARCH FOR DEVELOPMENT

IITA Research to Nourish Africa

A broad alliance of research-for-development stakeholders & partners

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ACRONYMS

A4NH	CGIAR Research Program on Agriculture for Nutrition and Health
ARI	Advanced research institute
BASICS	Building an Economically Sustainable, Integrated Seed System for Cassava in Nigeria Project
BBTD/V	Banana bunchy top disease/virus
Bioversity	Bioversity International
BMGF	Bill and Melinda Gates Foundation
BXW	Banana *Xanthomonas* wilt
CBSD	Cassava brown streak disease
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CGIAR	Organization dedicated to international agricultural research
CIALCA	Consortium for Improving Agriculture-based Livelihoods in Central Africa
CIAT	International Center for Tropical Agriculture
CIP	International Potato Center
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
Cluster	Cluster of Activities
CMD	Cassava mosaic disease
CRP	CGIAR Research Program
CWB	Cassava witches' broom disease
DArTseq	Diversity Arrays Technology sequencing
DNA	Deoxyribonucleic acid
DRC	Democratic Republic of the Congo
EAHB	East African Highland Bananas
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária
ENDURE	Expanding utilization of roots, tubers and bananas and reducing their post-harvest losses project
FinPlan	Financial plan
FP	Flagship project
GBS	Genotyping-by-sequencing
GM	Genetically modified
GREAT	Gender-Responsive Researchers Equipped for Agricultural Transformation Project
GWAS	Genome-wide association study
HH	Household
HQCP	High-quality cassava peel
Humidtropics	CGIAR Research Program on Integrated Systems for the Humid Tropics
IAU	Independent Audit Unit
ICVs	Improved cassava varieties
IDO	Intermediate Development Outcome
IEA	Independent Evaluation Arrangement
IFAD	International Fund for Agricultural Development
IITA	International Institute of Tropical Agriculture

ISC	Independent Steering Committee
ISPC	CGIAR Independent Science & Partnership Council
LAC	Latin America and the Caribbean
Livestock & Fish	CGIAR Research Program on Livestock and Fish
M	Million
MAS	Marker Assisted Selection
M&E	Monitoring and evaluation
MEL	Monitoring Evaluation and Learning platform
NaCRRI	National Crops Resources Research Institute, Uganda
NARO	National Agricultural Research Organization, Uganda
NARS	National agricultural research system
NDVI	Normalized Difference Vegetation Index
NGO	Nongovernmental organization
NIRS	Near-infrared spectroscopy
NRI	Natural Resource Institute, UK
NRM	Natural Resources Management
OCS	One Corporate System
OFSP	Orange-fleshed sweetpotato
PMU	Program Management Unit
PVS	Participatory varietal selection
QTL	Quantitative trait loci
RAAIS	Rapid Appraisal of Agricultural Innovation Systems
RBM	Results-based management
RFLP	Restriction Fragment Length Polymorphism
RHUL	Royal Holloway University of London
RNA	Ribonucleic acid
RTB	CGIAR Research Program on Roots, Tubers and Bananas
SASHA	Sweetpotato Action for Security and Health in Africa Project
SBCC	Social and Behavioral Change Communication
SDSR	Single Disease Stem Removal
SNP	Single nucleotide polymorphism
SPHI	Sweetpotato for Profit and Health Initiative
SSA	Sub-Saharan Africa
SUSTAIN	Scaling Up Sweetpotato Through Agriculture and Nutrition
TIB	Temporary Immersion Bioreactor
TBD	To be determined
TMS	Tropical Manioc Selection
UAV	Unmanned Aerial Vehicles
W1/2/3	Window 1/2/3 – CGIAR Funding system
WUR	Wageningen University
YIIFSWA	Yam Improvement for Income and Food Security in West Africa Project

PART I: TECHNICAL REPORT

A. KEY MESSAGES

A.1 Synthesis of progress and challenges

The CGIAR Research Program on Roots, Tubers and Bananas (RTB) covers banana (and plantain), cassava, potato, sweetpotato, yam, and other roots and tubers. RTB restructured in 2016 by flagship projects (FPs) and clusters of activity. The Phase II Proposal incorporated elements of Humidtropics to enhance scaling and sustainable intensification. It was highly rated by the CGIAR Independent Science & Partnership Council (ISPC) who commented "this is a strong all-round proposal, benefiting from stable and capable management, and building on good progress demonstrated to date. The CRP has carried out a very thorough prioritization process."

In 2016 we concluded Phase I of RTB, so it's timely to take stock of some headline achievements.

Governance: we have a dynamic and diverse Independent Steering Committee (ISC) which contributed to enhanced program performance, more structured gender research and our capacity to deal with risk.

Partnerships: we engaged strategic new partners with complementary expertise. CIRAD came on board as a full RTB program participant and leads the cluster on cassava processing with unique skills such as drying technology (publication), also contributing to genomic research (publication). Wageningen University (WUR) took on cluster leadership in 2016 and strengthened focus on scaling. Other significant up stream partnerships were with Royal Holloway University of London (RHUL) with pathbreaking work on metabolomics, NRI for postharvest evaluation and sensory analysis (publication) and Cornell for next generation breeding and gender. Novel downstream partnerships included NARO for postharvest innovation (blog) and NRCRI for cassava seed system development (blog).

Value added as program: we built a strong cross-crop and center knowledge base through competitive grants ("complementary funded projects") making up about 1/3 of W1&2 research funding (2/3 was for strategic crop-specific research). Proof-of-concept studies identified genomic regions linked to important complex traits such as virus resistance, dry matter and carotenoid content in cassava, parthenocarpy and sterility in banana, heat tolerance and micronutrient composition in potato. This will underpin work to accelerate genetic gains in Phase II. Similarly, capability to understand and intervene in clonally propagated seed systems significantly improved via a suite of diagnostic tools including; 1) an integrated seed health strategy for managing seed degeneration (publication); 2) modelling of seed degeneration linked to a comprehensive data base of trial data from degeneration studies; 3) a framework and linked case studies for analyzing coordination amongst seed system stakeholders; and 4) methods for impact network analysis to understand flows of seed, knowledge, pathogens and collaboration amongst actors. These four tools will be applied to enhance ongoing seed system interventions in Phase II.

Gender: we made strong progress on integrated gender research in Phase I by developing and applying gender-responsive guidelines and tools for participatory varietal selection, assessment of end-user preferences, integrated pest management and participatory value chain analysis. Fifteen RTB cases studies with GENNOVATE enhanced knowledge of changing norms and agency for gender equity, with one key finding around the role of women as gatekeepers of integrated agri-food systems.

Outcome orientation: we progressed with results-based management (RBM) and the RBM pilot, which continued in 2016 with Banana *Xanthomonas* wilt (BXW) and potato seed. The pilot served to develop outcome oriented monitoring and evaluation (M&E), test data collection tools and establish baselines in selected geographies (Uganda and DRC). The MEL (Monitoring Evaluation and Learning) platform became fully functional to provide a more user friendly interface for annual planning and reporting.

In 2015 and 2016, the W1&2 funding environment was characterized by uncertainty, reductions and late transfers. Through careful management and the willingness of implementing centers to pre-finance and absorb budget reductions, the impact on the workplan was reduced (see G.).

A.2 Synthesis of two most significant achievements

World Food Prize acknowledges the value and success of CIP's work on OFSP to address malnutrition. Three CIP scientists were awarded the 2016 World Food Prize acknowledging CIP's progress to link agriculture, nutrition and health sectors and get pro-vitamin-A orange-fleshed sweetpotato (OFSP) into the diets of an estimated 2.89M households in 12 Sub-Saharan African (SSA) countries[1]. This contributes to reduced risk of blindness, disease and premature death particularly among children. OFSP provides the strongest proof to date of the potential of biofortified crops for reducing micronutrient malnutrition in developing countries. A novel program in Western Kenya recently expanded proof of concept to achieve nutritional impact in coordination with health services (publication).

A key need was to breed for locally-adapted OFSP varieties that met African adult taste preferences. CIP's Accelerated Breeding Scheme reduced time from crossing to release from eight to four years. Since 2009, nine (SSA) countries released 56 new sweetpotato varieties (40 OFSP). Building institutional capacity for sustainable delivery of quality planting material through public and private sector multipliers was critical for scaling. The orange branding campaign helped transform the image of sweetpotato as a resilient crop of the poor to a health food for all. Going-to-scale was organized under the CIP-led Sweetpotato for Profit and Health Initiative, a multi-partner, multi-donor effort to reach 10 million African households by 2020.

Progress towards marker assisted breeding for resistance to cassava brown streak disease (CBSD). Researchers at IITA and partner institutions have progressed in characterizing the genetic basis of field resistance to CBSD (a particularly devastating plant disease) to assist breeders develop new varieties with durable resistance and other desirable traits. Quantitative trait loci (QTL) have been associated with field resistance to CBSD in two clones and researchers are identifying genetic markers linked to those QTL that could be used in marker-assisted breeding (abstract #W112). This allows breeders to select offspring at the seedling stage, reducing costs and the time to develop new varieties. Breeders also want to determine whether the genetic basis of resistance differs in the clones, to combine sources of resistance and increase durability of CBSD resistance in new varieties.

A.3 Financial summary

The total 2016 budget was USD 92.4M, USD 14.2M (15%) from W1&2 funding and USD 78.2M (85%) from bilateral and W3 funding. This includes USD 2.9M reduction in W1&2 from financial plan (FinPlan) due to reduced donors' contributions (17% less than FinPlan USD 17.0M). Total expenditures were USD 84.9M, or 92% of the budget, of which USD 14.1M (17%) is from W1&2, and USD 70.8M (83%) from W3, bilateral and centers' other funds. W1&2 expenses reached 99% execution of the revised budget and W3, bilateral and centers' other funds expenditure reached 91% execution. In 2016, USD 5.3M corresponds to Complementary Funded projects, which represents 38% of W1&2 and 6% of total expenditure. Of total expenditure, 7.6% was on gender research and 16% was reported as collaboration with partners.

[1] Estimate is for September 2016

B. IMPACT PATHWAY AND IDOS

CRP and flagship level impact pathways, theories of change and targets including gender dimension were revised for the Phase II Proposal, see full set at this link.

Table 1: Example of indicators and aggregated targets for linked IDO and Sub-IDOs for 2022

IDOs	Sub-IDOs
1.4 Increased productivity 8M HH increased RTB yield through adoption of improved varieties and sustainable management	**1.4.1 Reduced pre- and -post production losses, including those caused by climate change** 1.5M farmer HH in RTB farming systems who adopted sustainable management practices.
	1.4.2 Closed yield gaps through improved agronomic and animal husbandry practices 5M farmer HH adopted quality planting material (improved RTB varieties or clean seeds). 1.5M farmer HH in RTB farming systems adopted sustainable management practices.
	1.4.3 Enhanced genetic gain Increase in yield under researcher controlled trials and other changes in quality parameters. Crop x trait specific targets
	1.4.4 Increased conservation and use of genetic resources 5 RTB diversity key hotspots with improved conservation status of wild relatives & landraces.
Other related sub-IDOs	**3.3.1 Increased resilience of agro-ecosystems and communities, especially those including smallholders** 30 National & regional plant protection agencies with strategies for containment and management of pests and diseases developed using PRA and Climate Change scenarios.
	A.1.4 Enhanced capacity to deal with climatic risks and extreme 60 RTB-developed technologies & practices assessed in terms of adaptation to future climates.
	C.1.3 Conducive agricultural policy environment 66 policies, regulatory frameworks or programs led by government agencies, NGOs, and/or private sector in relevant topics that have included RTB research results in their design.
	D.1.1 Enhanced institutional capacity of partner research organizations 5 multi-stakeholder partnerships and scaling models under implementation.

C. PROGRESS ALONG THE IMPACT PATHWAY

C.1 Progress toward outputs

Principal achievements are listed by flagship project (FP). Detail is available in the crop (link) and complementary funded project reports (link).

FP1 - Enhanced genetic resources

Improving our understanding of cassava diversity and domestication*: A collaboration by CIAT, IITA and national partners using next-generation sequencing of elite breeding clones, landraces and crop wild relatives from Africa and Latin America to characterize the genetic structure of cassava shed new light on the crop's domestication and the relationship among populations. Accessions of the wild cassava relative (*Manihot glaziovii*) are strongly divergent from most cultivated varieties (*M. esculenta*), except for improved varieties from IITA, especially Tropical Manioc Selection (TMS) clones. This confirms historic records that TMS clones trace back to an interspecific hybrid (clone 58308) derived from backcrosses between *M. glaziovii* and *M. esculenta* in Tanzania (publication). In Latin America, CIAT scientists unraveled a subpopulation structure at the continental level to revisit the hypotheses of the crop's center of origin, suggesting that the most likely ancestor of cassava is *M. peruviana* Müll.-Arg. CIAT will undertake a thorough study in 2017 to determine the levels of *M. glaziovii* introgression in LAC cassava.

* Outputs, outcomes and impact studies which received significant W1/2 funding are marked with asterisk.

Bioinformatics pipeline for more efficient virus discovery*: To improve the identification and management of sweetpotato viruses – a major constraint for farmers in the tropics – CIP researchers developed an automated bioinformatics pipeline, combined with deep sequencing and assembly of virus-derived small interfering RNAs (sRNA) for the analysis of large-scale sRNA datasets to identify known and novel viruses. Called 'Virus Detect,' the pipeline performs both reference-guided assemblies through aligning sRNA sequences to a curated virus reference database and de novo assemblies of sRNA sequences with automated parameter optimization (publication). Once it is validated, this tool is expected to reduce costs and increase the speed of testing sweetpotato germplasm, breeding material and propagation material for viruses. This will facilitate germplasm and breeding material distribution.

Using genomic data to accelerate potato biofortification: Identifying genes or genomic regions associated with high iron and zinc content in potato would accelerate the development of new biofortified potato varieties through the exploitation of marker-trait associations, while increasing the predictability of such breeding efforts. Therefore, genome-wide association study (GWAS) experiments were conducted in a panel of 2X landrace potatoes. Germplasm was genotyped using Genotype by Sequencing (GBS) and field tested at two locations differing in soil zinc content. Using a mixed linear model, four GBS markers were significantly associated with iron and seven with zinc concentration. In 2017 these loci will be validated as candidates for marker assisted selection (MAS).

FP2 - Productive varieties & quality seed

Sweetpotato heat stress tolerance assessed for molecular marker development*: The phenotypic variability of sweetpotato in response to heat stress was characterized by a field experiment in the coastal desert of Peru exposing 1,973 sweetpotato accessions to heat and non-heat stress, using fast throughput thermographic and digital imaging. A total of 77 and 104 clones performed well in both treatments producing >6 t ha^{-1} on a dry matter basis 120 and 150 days after planting, respectively. A heat stress tolerance index was calculated identifying high yielding, early bulking and heat tolerant varieties and landraces. Preliminary results show a strong heterogeneity in plant growth (i.e. leaf area index) and thermal signatures among sweetpotato accessions, revealing a plant-specific response to heat stress but no correlation between Normalized Difference Vegetation Index (NDVI) and storage root production. Further analysis will explore the relationship between canopy thermal signature and yield parameters to test whether thermal imagery can be used for massive screening. Accessions were ranked on agronomic performance using the Pesek-Baker index, and divided into best and worst performers, and 357 accessions were genotyped by Diversity Arrays Technology sequencing (DArTseq) to identify genomic regions and SNPs associated with heat tolerance traits e.g. canopy temperature, chlorophyll content, canopy coverage and yield parameters. DArTseq analyses with a strong phenotypic data set will identify molecular markers for heat stress tolerance to make screening in early breeding stages faster.

Rapid production of high quality seed yams in Ghana: Yam has a low multiplication rate, which slows efforts to get improved varieties to farmers. IITA has developed a system for using the SETIS™ type Temporary Immersion Bioreactor System (TIBs) for rapid production of pathogen-free pre-basic seed yam to support a formal seed system. Pathogen-free plantlets of *Dioscorea alata* and *D. rotundata* were introduced into TIBs for multiplication. The plantlets were then hardened and either potted in soil for harvest after 6 months as pre-basic seed tubers or planted in aeroponics (a rapid plant propagation system in which roots grow in a fertilized mist) for basic seed production. The system showed that four 8-week cycles per year will give 8x8x8x8=4,096 plantlets. An average weight of 425g tuber per plant was harvested from the potted plants. In addition, a solar-powered aeroponic system was built at the Crops Research Institute of the Council for Scientific and Industrial Research in Kumasi, Ghana to produce disease-free tubers and vine cuttings for two improved and two local yam varieties (publication).

FP3 - Resilient crops

Strengthening cassava disease management through community phytosanitation: A pilot study on community phytosanitation to control CBSD in two regions of Tanzania showed good potential. Following a year of preparing community members, infected material with more than 90% CBSD incidence was harvested and replaced with disease-free material of improved varieties (cv Mkombozi in Chato and cv Kiroba in Mkuranga). During the next growing season, farmers controlled CBSD by roguing any improved variety plants that showed symptoms. In the following two seasons, two other groups of farmers received planting material of improved varieties and applied community phytosanitation. Kriging and geostatistics showed that community phytosanitation had an area-wide impact in reducing the levels of CBSD inoculum pressure. After three seasons, CBSD incidence in the community phytosanitation areas was below 40%, whilst after one season of growing the improved variety Mkombozi without phytosanitation, the incidence was above 60%. Community phytosanitation can deliver sustained, area-wide reductions in CBSD impacts and higher yields. The pilot study, was a novel and highly successful partnership run by the national program, supported by IITA as a sub-grantee and financed by BMGF, building the basis for scaling supported by FP5 (poster).

Studying the etiology of cassava witches' broom disease (CWB) to improve management: CWB, a systemic disease caused by phytoplasmas, has impacted millions of farmers in Southeast Asia, causing average yield loss of 30-35% and lower root quality. CIAT worked with national partners to understand the pathogen and insect vectors and improve surveillance in the region (link to conference abstract and poster). Together, they developed a step-wise process to identify candidate insect vectors and elucidate the role of different species of leaf- and planthoppers in pathogen transmission. CIAT developed an isothermal DNA amplification technology to detect the pathogen in the field, used by researchers around the world (video), and performed restriction fragment length polymorphism (RFLP) analyses, cloning, and sequencing to understand the CWB phytoplasmas behind widespread yield loss in Cambodia.

A banana seed option for communities dealing with Banana Xanthomonas wilt (BXW)*: BXW is the biggest constraint to banana production in East and Central Africa, where management recommendations are to either cut diseased stems or destroy entire mats in which the disease's symptoms appear. The challenge facing smallholders is finding disease-free planting material to replace the mats they destroy. In eastern DR Congo, RTB scientists assessed the viability of using symptomless suckers sourced from fields with >70% BXW incidence as planting material. In North Kivu Province, symptomless suckers were planted 10 days after roguing banana fields with >70% XW incidence. Symptomless suckers planted in fields previously under grass fallow served as checks. Healthy suckers and macro-propagated plantlets were established in similar field typologies. Additional experiments in South Kivu Province using symptomless suckers sourced from fields with plant disease incidence levels varying from 1-90 % assessed the reproducibility of the North Kivu results. Relatively low cumulative BXW plant incidences of 3.6% and 4.2% were recorded in fields previously under grass fallow and fields with >70% initial BXW-incidence, respectively. The resulting fields established well, suggesting that suckers sourced from diseased fields could potentially be used in zones with no access to clean planting material. Even lower incidences (0-0.28%) recorded in South Kivu further confirm this.

FP4 – Nutritious food and value added through post-harvest innovation

Flash dryer optimization to reduce energy costs in cassava processing in Africa*. Joint work by CIAT, CIRAD and IITA analyzing the characteristics of tunnel and pneumatic or flash dryers, resulted in the design and blueprints of a small-scale energy efficient flash dryer. Construction started in November 2016 at CIAT, in collaboration with Univalle, and is expected to end by March 2017. In Tanzania and Nigeria, the findings of 2014-2015 were applied to reduce air flow to near the theoretical minimum value. In both locations, heat inputs decreased by 13-20% without jeopardizing evaporation rates, or affecting the final

moisture content and product quality. Strong interaction with private sector partners for modifying dryers and analyzing performance was critical to success. (publication)

World Food prize work on OFSP is part of **FP4** cluster.

FP5 – Improving livelihoods at scale

Building networks to promote drone-based remote sensing in agriculture. For over 15 years CIP has conducted research on drone-based remote sensing, to develop low-cost field phenotyping platforms. This resulted in the Unmanned Aerial Vehicle – Agricultural Remote Sensing Integrated Platform (UAV-ARSIS), including custom-made solutions such as multi-spectral cameras and Open Source software for the registration, geometric correction and aligning of multi-spectral imageries, and the generation of mosaics and processing of data. The UAV4Ag community of practice is jointly moderated by the Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA) and CIP with 600+ members from research organizations, public extension services, private sector and farmer organizations from 90+ countries.

Impact and Gender research achievements are part of or linked with FP5.

C.2 Progress toward the achievement of research outcomes and IDOs

IDO: Increased productivity

Cassava processing technologies in Uganda: In the last decade, IITA and partners introduced an extensive range of processing technologies that allow farmers to harvest and process cassava into shelf-stable value-added products. Researchers recently studied adoption and impact (publication). Technologies most adopted in mechanized- and nonmechanized processing villages were mechanical milling with 68% and 49% mean adoption rates and sun drying of cassava on raised platform with 68% and 3% adoption rates, respectively. A stochastic production function, using translog functional form, was used to compare efficiency measures of farmers in mechanized cassava-processing villages with the farmers in non-mechanized cassava-processing villages. Adoption raised mean technical efficiency of farmers in villages to 0.69 (69% of maximum possible technical efficiency) and 0.52 (52% of maximum possible) in villages with no mechanization. Mechanization facilitated improvement in production efficiency through greater access to markets and sales of cassava roots to mechanized processors. If done at the right scale, mechanized cassava processing could transform primary production for increased yields into higher incomes, improved farming efficiency, and increased competitiveness of cassava production in Africa.

Rooted potato cuttings could transform African seed systems: As CIP works to promote disease-free seed potato production in Africa, the use of rooted potato cuttings shows great potential. Apical cuttings are produced from tissue culture plantlets in the screenhouse, and after rooting, are planted in the field. This newly introduced technology can significantly reduce the time needed for and cost of producing certified seed potatoes in SSA, compared to the current best technology based on minitubers. Whereas traditional systems require 26 months to produce certified grade 1 seed, following three field generations, rooted potato cuttings can permit the production of 15,000 seed tubers in 17 months from a single tissue culture plant. This can cut unitary costs from US$ 0.19 to US$ 0.16 per kg. The technology's use is expanding in Kenya, where it could replace minituber production. Two businesses have invested in rooted cuttings, as have 40 decentralized seed multipliers, and Kenya's national potato program is using rooted cuttings for basic seed production. This technology has the potential to reduce the need to import seed, increase the availability of seed for improved varieties, reduce seed degradation, and increase yields.

Sweetpotato animal feed technology takes off in Uganda: Pig production has doubled in Uganda over the past decade, with 17 percent of the population raising pigs, most of them women or youth, as a backyard activity, yet feed costs represent 62-70 % of their variable production costs. CIP implemented

proof-of-concept research on a sweetpotato-based silage for pig feed in Kenya and Rwanda in 2009-2013 and found that it could reduce feed costs by up to 40 percent compared to commercial feed. Under the RTB-ENDURE project, CIP collaborated with Bioversity, IITA and the International Livestock Research Institute to scale out this technology in Uganda in 2014-2016, training farmer associations and NGO partners that created business centers to make and sell silage, provide technical services (e.g. machine rentals), and offer fee-based training in the technology. Those business centers trained several successful silage makers, including youth groups that purchased their own equipment and sold a total of 77 tons of silage to pig farmers during the second half of 2016. An additional 72 farmers have bought silage directly from the business centers. Silage is currently sold at $0.12/kg, already offering a good profit, and a study found that farmers are prepared to pay up to $0.18/kg. A large company, Pig Production and Marketing Ltd., is now promoting silage use and training its suppliers. CIP expects 10 percent of sweetpotato and pig farmers in the central Uganda districts of Masaka, Mpigi, Kamuli and Mukono to adopt the technology (media content).

IDO: Improved diets for poor and vulnerable people

Yam project reduces poverty and food insecurity: Researchers collected data on 600 yam-farming households that had benefitted directly or indirectly from the Yam Improvement for Income and Food Security in West Africa project. Many reported higher yam yields and mean productivity, with poverty incidence 10% less than in non-beneficiary communities. Comparing endline and baseline data, the proportion of households reporting occasional food shortages decreased from about 62% to 35%, and households reporting food surplus increased from about 8% to 34%.

Understanding women and men farmers' perceptions on the benefits of growing orange fleshed sweet potato (OFSP)*: CIP and partners used a social relations approach to examine men's and women's perceptions of the economic and health benefits of OFSP in the Phalombe and Chikwawa districts of Malawi (publication). Researchers gathered data from sex-disaggregated focus groups, with approx. 10 participants each, for a total of 178 farmers who grow OFSP. Both men and women farmers cited economic and health benefits as key motivations for cultivating OFSP, however focus group data revealed significant differences among men and women in the use of the crop and earnings from its sale. Women often trade roots for other crops to diversify the family diet. The sale of vines as OFSP planting material is especially seen as being more financially rewarding. Nevertheless, women's inclusion in vine markets is limited by access to resources (e.g. irrigation equipment), control over household income and cultural norms favoring selection of male farmers for project interventions.

IDO: National partners and beneficiaries enabled

RTB crops key part of multi-stakeholder research with the Consortium for Improving Agricultural in Central Africa (CIALCA): work with the Humidtropics CRP targeted the testing and scaling of RTB-focused innovations. CIALCA, implemented by IITA, Bioversity and several public and private sector partners, operated through multi-stakeholder platforms in Burundi, Rwanda and DR Congo. RTB innovations tested by these platforms included cassava intercropping, Vitamin A rich bananas, banana seed multiplication through macropropagation, and Single Disease Stem Removal (SDSR). FP5 scientists supported multi-stakeholder partnerships in identifying, implementing and evaluating their innovation and scaling efforts. Tools such as Rapid Appraisal of Agricultural Innovation Systems (RAAIS) supported the formulation of Entry Points for Innovation that could contribute to the sustainable intensification of RTB farming systems.

C.3 Progress towards impact

Cassava technologies and poverty reduction in Africa: Based on a survey of 1,919 households, IITA researchers used a regression model to determine whether adoption of improved cassava varieties (34%

adoption) led to rural poverty reduction in Tanzania, Democratic Republic of Congo, Sierra Leone and Zambia. The model showed an approximately 10% reduction in the poverty rate amongst the total population of 690,000 households in the districts studied with a greater reduction in female headed households. This implies that, controlling for the observable and unobservable heterogeneities in household characteristics, female-headed households are not disadvantaged relative to male-headed households when it comes to cassava technology.

Changing patterns of adoption in Vietnam*: 984 cassava growers in 82 farming communities were interviewed and more than 3,700 samples of cassava planting material were collected for DNA analysis. Preliminary analysis shows 85% of cassava varieties grown are improved, all related to CIAT germplasm. The CIAT-related variety KM94 (a.k.a. KU50) has lost importance in Vietnam, (31% of area in 2015), whereas the CIAT-bred variety KM419, released in 2013, is now dominant (38% area).

Potato and Sweetpotato adoption assessments*: Considering the data gap on adoption in Asia and cost of gathering household level data, CIP organized 41 expert elicitation workshops in the top nine potato- and sweetpotato-producing countries in Asia; 575 national potato and sweetpotato experts followed a standardized procedure to compile information on variety releases and adoption. CIP-related material is estimated at 30% of the improved potato and sweetpotato varieties (61 in total) adopted. Approximately 25% of the potato growing area in China (1.2M ha) is planted with varieties that were either developed by Chinese breeders using CIP progenitors (13%) or are CIP-bred (12%).

D. GENDER RESEARCH ACHIEVEMENTS

RTB teamed up with Cornell and Makerere Universities' GREAT program (website)*: An applied training course on Gender-Responsive Root, Tuber and Banana Breeding, was given to 11 teams, and 33 RTB program and strategic partner researchers (including many national programs with Bioversity, CIP, CIRAD and IITA) involved in research on banana bunchy top disease, banana Xanthomonas wilt, cassava breeding and processing, potato production, banana breeding, micro-nutrient enhanced cassava and sweetpotato improvement. The first part of the course was held in September in Kampala with a follow-up in 2017. Participation of researchers was largely supported by the GREAT program, with co-funding from RTB through gender projects where RTB gender specialists are working as mentors and trainers. RTB is planning an adapted version of the GREAT training in both Asia and Africa with biophysical scientists and gender researchers through capacity development training and workshops.

Gender differentiated end-user preferences*: Under a broader cross-cutting topic - Aligning research with farmers' and end-users' priorities in RTB crops – all partner centers incorporated tools for gathering gender differentiated trait preferences in Participatory Varietal Selection (PVS). Bioversity completed a gender-responsive baseline to characterize the target population environments for Narita banana hybrids in terms of agroecological and socioeconomic conditions and existing production systems in five sites in Uganda and Tanzania. CIAT gathered sex-disaggregated data on gender preferences on key traits for the adoption of a new variety of cassava in five provinces of Vietnam and data analysis is in process. A study on cassava trait preferences in Nigeria led by IITA suggested important implications for trait prioritization for breeding where women had preferences for suitability for underground storage, maturity time and ease of peeling. PVS studies with potato in Ethiopia suggested women gave more consideration to shape and shallow eyes which makes peeling easier.

Social and behavioral change communication to improve OFSP uptake: CIP developed a gender responsive social and behavioral change communication (SBCC) strategy to promote adoption of improved OFSP varieties by men and women in Bangladesh, Malawi, Rwanda and Kenya. Prior research in Malawi and Tanzania showed that women were more willing than men to purchase disease-free OFSP

planting material because they had received training on OFSP's health benefits. However, men are the main decision makers on the use of land and other resources, yet they weren't targeted with the nutrition messaging. The SBCC strategy includes adjusting such messaging for each gender and culture. CIP has begun applying the strategy in Bangladesh, where nutrition information is complemented by training in hygiene and child care, and Malawi, where men made up over 40% of participants in nutrition training under the SUSTAIN project in 2016.

Understanding gender's role in BXW control*: In order to inform efforts to control the banana disease Xanthomonas wilt (BXW) – a major threat to smallholder livelihoods in Central and Eastern Africa – RTB researchers studied 341 farm households in Uganda to determine how gender influences perceptions of the disease and management strategies. Using sex-disaggregated data, they analyzed whether men and women share similar perceptions of BXW control technologies and how gender influences choices in BXW management. Among other things**,** the results showed that fewer women than men believe cutting down single BXW infected plants is effective, yet are more likely than men to cut down infected plants if they are tasked with carrying out the strategy, which RTB has promoted. Men are more likely to buy tissue cultured banana plantlets to establish new plantations and/or gap-fill. Researchers found that whereas BXW resulted in only a 12% reduction in banana area at peak infestation, the disease destroyed up 77% of mean monthly production, which demonstrates the urgent need for gender-responsive strategies for mobilizing farmers to control it.

E. PARTNERSHIPS BUILDING ACHIEVEMENTS

Effective partnerships with a diversified set of organizations are essential for achieving RTB ambitious results (Figure 1).

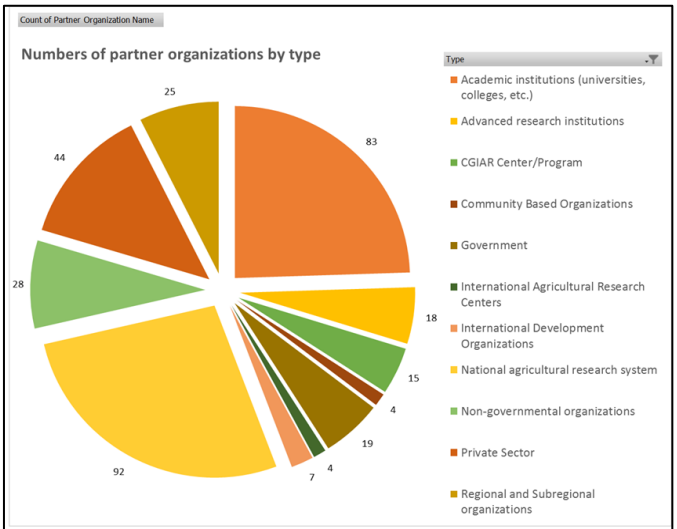


Figure 1. Organization types partnering with RTB

Collaboration with CRPs: Teamwork with Humidtropics on system approaches and tools (blog) as well as better design of innovation and scaling pathways, with WUR, contributed to the RTB proposal for Phase II. Joint development with PIM of gender-responsive value chain methodologies was strengthened, tools and lessons learned shared during a training workshop organized in collaboration with Pennsylvania State University. In East Africa, vitamin-A rich banana varieties were tested across different growing cycles and agroecological zones, as well as in local food dishes, in collaboration with A4NH and HarvestPlus. Joint work started with CCAFS on banana pest risk mapping and climate models.

Cassava: Jointly with the Global Cassava Partnership for the 21st Century (GCP21), the International Society for Tropical Root Crops (ISTRC), the Chinese Academy of Tropical Agriculture Sciences (CATAS), and Guangxi Cassava Research Institute (GCRI), RTB supported the organization of the First World Congress on Root and Tuber Crops (website). Scientific inputs provided by RTB scientists were made available through the electronic proceedings.

Potato: Increasing the quality of potato planting materials remains an issue in many countries. Georgia, where potato is considered a "second bread" and per capita consumption is over 50 kg/year, is not an

exception. CIP began collaborating with the Agricultural University of Georgia, the Ministry of Agriculture and the University of Natural Resources and Life Sciences in Austria to, introduce an integrated seed health approach for strengthening the national potato seed system (website).

Sweetpotato: Successful collaboration started in 2010 with Emory University (USA) for the Mama SASHA proof-of-concept project, in 2016 it provided scientific guidance for nutrition counseling and nutrition outcome monitoring methodologies to assess the scalability of the Mama SASHA concept. Building on this partnership, new going-to-scale initiatives started in Mozambique (USAID) and Ethiopia (EU). This highlights the value of continued science collaboration with partners as a transition occurs from proof-of-concept to scaling, and is positioning CIP and CGIAR as a reliable knowledge broker to connect new downstream delivery partners with international scientific expertise for the scaling out of OFSP technologies and nutrition practices. One example of a downstream delivery partner who has been brought in is the Czech NGO 'People in Need' to support OFSP scaling in Ethiopia.

Multi-crop*: Metabolomics provide precise phenotypic data for understanding physiological processes during plant growth and development. A cross-center, cross-crop collaboration with the Royal Holloway University of London (RHUL), led to the development of large metabolite profiles for cassava, banana, potato (publication), and yam (publication) with sweetpotato underway. RTB centers grew and characterized the plant material, and sent tissue to RHUL for metabolite extraction and analysis. Metabolite profiles were used to differentiate between cultivated and wild species as well as accessions, and to identify compounds related to drought responses or to quality attributes, that can be adapted for trait identification in breeding.

Multi-crop: Based on a multi-crop and multi-stakeholder approach, RTB-ENDURE demonstrates how research and development (R&D) organizations and value chain actors can work together to identify, assess, and promote best-bet innovations for expanding utilization and reducing postharvest losses of selected RTB crops. During a first scoping stage, National research centers, private sector enterprises, local NGOs and farmers' groups prepared business cases considering the technical, economic and social feasibility of different innovations. These were reviewed by an expert panel and the options with the strongest business case were implemented by teams of national partners with CGIAR centers, using the Participatory Market Chain Approach with a gender lens to stimulate private sector led innovation. This led to innovations for sweetpotato silage (see C2 above), better access to specialized ware potato markets, waxing for extending cassava shelf life, and product differentiation in cooking banana value chain (see Reports and Publications section on the project website for more details).

F. CAPACITY BUILDING

RTB provided short-term training (e.g. courses, workshops, seminars, on-the-job training, field days and community sensitizations) to 69,773 persons (24,273 women; 30,788 men; 14,712 no gender disaggregated data available) and supported long-term training (PhD, MSc, BSc) for 124 students (52 women, 72 men).

Table 2: Non-exhaustive list of topics facilitated in training programs

FP	Short-term programs	Long-term programs
1	Advanced plant breeding & quantitative genetics; Applications of bioinformatics & genomics to translational research in health & agriculture; In vitro propagation of tropical clonal crops; Molecular detection techniques; Regulatory and biosafety issues; Viral induced gene silencing.	Cryotherapy procedure for yam genotypes; Exploitation of heterosis in sweetpotato; Genetically modified organisms (GMOs) in East Africa: laws, regulations and public perceptions; Genetics of nematode resistance in banana; Morphological and ethnobotanical characterization of native potatoes; Genomic selection of EAHB
2	Gender and seed systems; PVS; Rapid multiplication for RTB planting material; Seed management and marketing	Yam seed degeneration

3	Agroecology; Agronomy; Cropping systems; Drone imaging; Integrated Pest Management; Spectroscopic methods for soil analysis	Chemical ecology of cassava whiteflies; Molecular characterization of *Ralstonia solanacearum*; Molecular techniques to determine pathogen (Fusarium wilt disease) content in banana fields; Effect of compost, lime and fertilizer on root and planting material yield of cassava
4	Nutritional quality and hygiene in RTB processing; Storage and post-harvest technologies and practices	OFSP awareness among lactating mothers and its contribution to β-carotene in bread; Preference and Willingness to Pay for High Quality Cassava Flour (HQCF) Wheat Bread in Southwest Nigeria
5	Modeling and data management; Farm yield assessment; Trial design and field data analysis; Gender and business planning; Gender in Agricultural Research; Use of social media for research and collaboration	Sustainable agroecological intensification of banana-based system

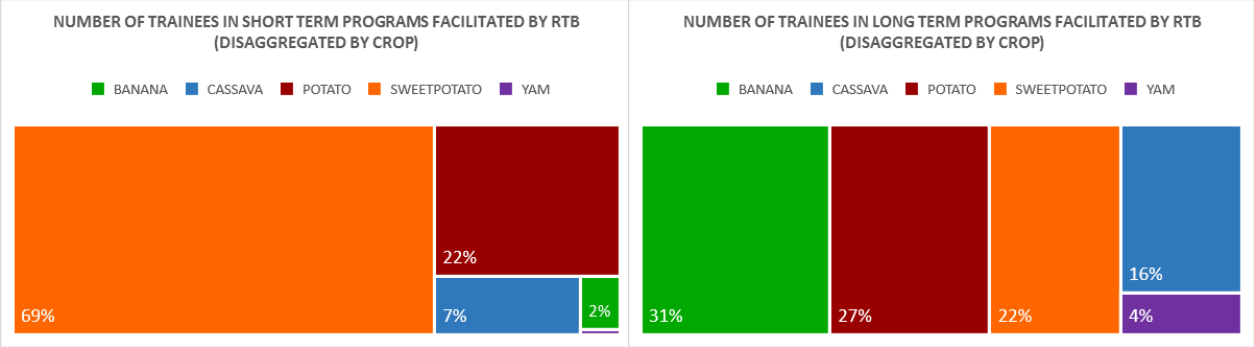


Figure 2. Number of trainees in short and long term programs facilitated by RTB

Sweetpotato R4D initiatives have been consistently investing in and tracking short-term training to reach farmers, vine multipliers, processors, value chains actors, researchers, technicians and officials from government and NGOs as part of a concerted scaling strategy (Figure 2). Efforts in long-term training are supported in a comparable manner across all crops.

G. RISK MANAGEMENT

The greatest risk related to the long-term decline in W1/2 funding and the uncertainty of the actual budget against the FinPlan even within the 2016 financial year. In the first years of Phase I, budgets were increasing and uncertainty could be set off against growth. This is not possible when overall W1/2 funds at the system level were static or trending down. In 2016, the final budget for the year was not available until November as some major W2 donors waited to hear the outcome of the CRP Proposal evaluation process. RTB, because of a very high dependence on W2, was exposed to a higher level of risk than those CRPs with more W1. This was a perverse incentive framework, as those CRPs which are successful to attract more W2 are "rewarded" by greater uncertainty on their budgets than those which are not. Through careful management and the willingness of implementing centers to pre-finance and absorb budget reductions, the impact on the workplan was reduced. Hopefully in the future it will be possible to achieve multi-year commitments from donors such that we are not waiting till third quarter or later each year to know the real budget and that a more appropriate incentive structure can be put in place.

This budgetary uncertainty creates a disincentive to prepare contracts with non-CGIAR partners who are unlikely to be able to bear the risk in the same way as CGIAR centers. There is significant reputational damage for the CGIAR with the partners who have endeavored to work with RTB. And field activities may be curtailed in the final quarter as salary commitments cannot be reduced in the short term, so the overall damage and impact on the program may be greater than the % reduction indicated.

H. LESSONS LEARNED

Integrating research agendas. Restructuring by flagship projects and clusters of activity offered the opportunity to review the RTB research portfolio. In the light of nested impact pathways, outputs were organized in research areas (so called "Products" in the cluster structure), consolidated to make the portfolio more manageable, and harmonized across crops to facilitate knowledge management. Because of RTB multi-crop nature, the exercise was exciting and challenging. The richness and complexity of the research portfolio reflect an integrated agenda with connected discovery and delivery pipelines and strengthened research on scaling strategies to foster innovations in RTB-agri-food systems.

RBM: improving how to measure progress. Based on the analysis of indicators in Annex 1, RTB began developing: 1) specific metrics for measuring progress along breeding pipelines, led by the *Breeding CoP* (Cluster DI1.1); 2) a framework for assessing and monitoring the "readiness" for going to scale of technologies under research, led by Scaling *RTB agri-food system innovations* (Cluster CC5.3). In both cases, the aim is to further develop the monitoring system to provide timely information for RBM, with a stronger outcome and user focus.

Interoperable online tools supporting monitoring and learning. Following consultation with other CRPs and Centers, RTB introduced the MEL platform for planning and reporting. This was well received by scientists, after teething pains, and facilitated reporting. However, some CRPs opted for other platforms. RTB will regularly compare MEL performance with alternatives and look for interoperability and data export and import functions with other tools, including OCS, CGSpace and dataverse. Ideally centers and RTB would use the same platform so that data can be entered a single time at the center level for simultaneous use by RTB. Of course, the greater the alignment between center and RTB program structure, the easier this process will be (see following point below).

Alliance model for effective governance. The IEA review pointed out that RTB functions on an "alliance" in which the program participants (four CGIAR centers and CIRAD) under the overall leadership of CIP jointly agree on research planning and implementation. IEA's Recommendation #16 specifically related to the need for a soft contractual vehicle to align strategic objectives of RTB program participants (and offset some of the risks described under G.). This was taken up by ISC and PMU and work continues to draft a set of strategic statements to be agreed by centers in six areas: 1) RTB partnership collaboration; 2) Inclusive partnership; 3) Strengthening business partnerships for RTB; 4) RTB and donor relations; 5) RTB and talent management and 6) Communications.

Annex 1: RTB indicators of progress in 2016[2]

Indicator	**Deviation narrative** (if actual is more than 10% away from target)	2016[3]	
		Target (if available for 2016)	**Actual**
KNOWLEDGE, TOOLS, DATA			
1. Number of flagship "products" produced by CRP	Selected set of methodological frameworks has been highlighted when reorganizing the RTB portfolio	23	13
2. % of flagship products produced that have explicit target of women farmers/NRM managers	Conceptualization of methodological frameworks with gender experts' contribution	25%	69% (9)
3. % of flagship products produced that have been assessed for likely gender-disaggregated impact	Assessment of methodological frameworks more often realized in collaboration with gender team	50%	46% (6)
4. Number of "tools" produced by CRP		67	64
5. % of tools that have an explicit target of women farmers		34%	27% (17)
6. % of tools assessed for likely gender-disaggregated impact		18%	16% (10)
7. Number of open access databases maintained by CRP	Closer tracking has revealed higher number of databases maintained / fed	22	28
8. Total number of users of these open access databases	Target exceeded even if most of the databases do not have an effective mechanism for tracking user. Use of databases should be better defined (e.g. visits, downloads, direct engagement)	105,000	148,790
9. Number of publications in ISI journals produced by CRP		120	112
10. Number of strategic value chains analyzed by CRP		11	9
CAPACITY ENHANCEMENT AND INNOVATION PLATFORMS			
13. Number of trainees in short-term programs facilitated by CRP (male)	Targeted exceeded; reflecting better tracking system in Centers	23,000	30,788
14. Number of trainees in short-term programs facilitated by CRP (female)	Targeted exceeded; reflecting better tracking system in Centers	10,500	24,273

[2] Indicators not relevant for RTB are left out. See explanations for indicators of progress: link

[3] Targets for 2016 as given in the Performance Matrix for the RTB Extension Phase 2015–2016.

Indicator	**Deviation narrative** (if actual is more than 10% away from target)	**2016[3]**	
		Target (if available for 2016)	**Actual**
Number of trainees in short-term programs facilitated by CRP (no gender-disaggregated data available)			14,712
15. Number of trainees in long-term programs facilitated by CRP (male)		60	72
16.Number of trainees in long-term programs facilitated by CRP (female)		60	52
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT			
18. Number of technologies/NRM practices under research in the CRP (Phase I)	Technologies and practices have been reformulated and consolidated when reorganizing the RTB portfolio in clusters and flagships	60	43
19. % of technologies under research that have an explicit target of women farmers		16%	16%
20. % of technologies under research that have been assessed for likely gender-disaggregated impact	Technologies and practices in early stage of development, not yet assessed	16%	7%
23. Number of technologies /NRM practices field tested (phase II)	Reduction in W1/2 and other disruptions to implementation lowered practices entering testing	96	66
27. Number of technologies/NRM practices released by public and private sector partners globally (phase III)	Closer tracking has revealed more progress than anticipated	33	43
POLICIES IN VARIOUS STAGES OF DEVELOPMENT			
28. Numbers of policies/ regulations/ administrative procedures analyzed (Stage 1)	Stewardship plans for banana and potato resistant varieties in SSA	5	3
29. Number of policies/regulations/administrative procedures drafted and presented for public/stakeholder consultation (Stage 2)		3	0
30. Number of policies/regulations/administrative procedures presented for legislation (Stage 3)	Quality declared planting material regulations; Priority setting for public investments	1	4
31. Number of policies/regulations/administrative procedures prepared passed/approved (Stage 4)	Seed policies and regulations frameworks; Procedures and mechanisms for increased investment in biofortification	1	3
32. Number of policies/regulations/administrative procedures passed for which implementation has begun (Stage 5)	Strategic plans to accelerate the scaling of biofortified crops	1	3

Indicator	**Deviation narrative** (if actual is more than 10% away from target)	2016[3]	
		Target (if available for 2016)	**Actual**
OUTCOMES ON THE GROUND			
33. Number of hectares under improved technologies or management practices as a result of CRP research	Includes adoption of technology released prior to start-up of RTB	447,000 (new)	447,000 (new)
34. Number of farmers and others who have applied new technologies or management practices as a result of CRP research	Total	1,780,000 (new)	1,780,000 (new)
	34 (a) number of women farmers concerned	510,000 (new)	510,000 (new)
	34 (b) number of male farmers concerned	1,270,000 (new)	1,270,000 (new)

Annex 2: Performance indicators for gender mainstreaming with targets defined

Performance Indicator	CRP performance approaches requirements	CRP performance meets requirements	CRP performance exceeds requirements
1. Gender inequality targets defined	*Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations*	*Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations* *AND* *The CRP has defined and collected baseline data on the main dimensions of gender inequality in the CRP's main target populations relevant to its expected outcomes (IDOs)*	*Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations* *AND* *The CRP has defined and collected baseline data on the main dimensions of gender inequality in the CRP's main target populations relevant to its expected outcomes (IDOs)* *AND* *CRP targets changes in levels of gender inequality to which the CRP is or plans to contribute, with related numbers of men and women beneficiaries in main target populations*

In terms of defining **gender inequality targets, RTB performance meets requirements**.

- The RTB gender team has worked with scientists and flagships and cluster leaders to provide technical backstopping in the development and implementation of survey instruments, tools, and checklists to facilitate collection and analysis of sex-disaggregated data (e.g. *6279 - Gender Formative Evaluation: VISTA Project Tanzania; 6280 - Analysis of sweetpotato vine multiplication in Phalombe and Chikwawa in Malawi: Implications for gender, agroecoecology and sustainability; 3205 - Gender situational analysis of ware potato value chain and strategies for gender equity in postharvest innovations; 4850 - Case study of gender roles in the gari value chain in Benin (part 2): Full-scale surveys using the optimized questionnaires; 5259 - Technical Report: Gender situational analysis of sweetpotato; 4566 - Guidelines for gender-responsive control of BBTD; 4571 - Gender mainstreamed guidelines for designing RTB post-harvest technologies and RTB interventions in Uganda*)
- To date, RTB collected sex-disaggregated baseline data (both qualitative and quantitative) related to access to resources, decision making, gender division of labor, participation in different aspects of production and marketing, and gender-related constraints and benefits in technology adoption for:
    - Banana beverage value chains (Burundi, DRC, Rwanda, Tanzania, and Uganda)
    - Cassava value chains (Benin, Colombia, Nigeria)
    - Potato and banana seed systems (Malawi and Burundi)
    - Management and effects of banana priority pests and diseases (Burundi, DRC, Malawi and Uganda)
    - Gender differentiated adoption drivers for new banana hybrids in East African highlands (Tanzania and Uganda)
    - Gender related opportunities and constraints for the dissemination of integrated agriculture - nutrition technology set (OFSP) (Tanzania)
    - Cassava and IPM in Southeast Asia (Vietnam and Laos)
- In 2016 RTB – Gender Focal Points (GFPs) contributed to the consolidation of GENNOVATE results in global-level publications and RTB Africa cases study.

Performance Indicator	CRP performance approaches requirements	CRP performance meets requirements	CRP performance exceeds requirements
RTB has a total of 15 cases in GENNOVATE and the consolidated report is being finalized.			
2. Institutional architecture for integration of gender in place	• *CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORs* • *Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy* • *CRP M&E system has protocol for tracking progress on integration of gender research*	• *CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORs, and funds allocated to support their interaction* • *Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy* • *CRP M&E system has protocol for tracking progress on integration of gender research* *AND* • *A CRP plan approved for capacity development in gender analysis*	• *CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORs, and funds allocated to support their interaction* • *Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy* • *CRP M&E system has protocol for tracking progress on integration of gender research* • *A CRP plan approved for capacity development in gender analysis* *AND* • *The CRP uses feedback provided by its M&E system to improve its integration of gender into research*

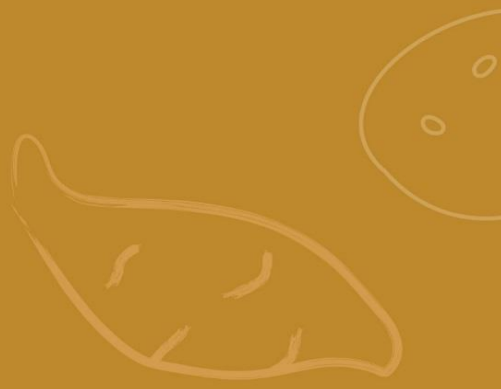
In terms of defining institutional architecture for integration of gender in place, **RTB performance meets requirements**.

RTB has strengthened its gender team. The team is currently constituted by: five gender researchers in Bioversity, three in CIP, five in IITA and two in CIAT. In addition, Bioversity, CIP and IITA and Bioversity each have one CGIAR Consortium gender post-doctoral fellow. As in previous years, gender team counted on funds specifically allocated through complementary funded projects.

In programmatic aspects, RTB integrated gender into its institutional architecture in the following way:

- Development of a gender sensitive research portfolio for RTB second phase:
  - Flagships 2 to 5 are directly contributing to the crosscutting IDO on equity and inclusion and the breeding CoP (Cluster DI1.1) in Flagship 1 is hosting the work on gender and breeding and contribute to gender-responsiveness of discovery research.
  - Gender is integrated across all clusters and particularly in the following key areas: breeding, seed systems, pest and disease management, value chain development;
  - These research areas are clearly mapped in RTB research portfolio and receive dedicated funding.
- In the MEL platform, a tracking system for gender-responsive outputs is in place. In the planning phase, scientists add a tag to relevant outputs. When an output is tagged, it becomes easier to identify knowledge products (e.g. reports, publications, training materials) with relevant gender content. At the same time, in the reporting phase, scientists are requested to provide information on achievements and challenges related with the gender dimension of tagged outputs.

Performance Indicator	CRP performance approaches requirements	CRP performance meets requirements	CRP performance exceeds requirements
Capacity development events were conducted: • CIAT has co-organized with Australian Center for International Agricultural Research (ACIAR) a training on strengthening the gender lens in agricultural production and value-chain research in Vietnam. (link) • RTB GFPs contributed in designing the curriculum for the GREAT project which aims at building capacities of agricultural scientists for doing gender-responsive research. The first course was especially tailored towards RTB scientists and partners, in which one RTB GFP (from Bioversity) was the resource person and two (IITA and CIP GFP) were mentors to help guide the gender field work of the training. (link)			



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