RESEARCH PROGRAM ON Roots, Tubers and Bananas

CGIAR

Cluster annual report - 2017

BA3.4 Banana viral disease / BBTV: Improving livelihoods of smallholder banana producers through recovery and containment of BBTV

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RTB Cluster Report

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Cover: A village chief observing banana bunchy top infected plant in a community awareness raising meeting in Idologun, Ogun State, Nigeria. Photo. By L. Kumar

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

The key achievements in 2017 were related to (i) identification of resistance to BBTV in triploids (e.g. Fugamov) and synthetic tetraploids (e.g. PITA 21) with potential for deployment in the BBTV-affected sites to reduce virus inoculum and reinfection rate; (ii) development of a new isothermal Recombinase Polymerase Amplification (RPA) assay capable of detecting BBTV in plants and vectors on-farm, and a mobile app for disease surveillance and reporting to quarantine authorities; and (iii) demonstration of scalability of production recovery approaches in BBTD affected areas. Most notable was the successful implementation of the BBTD scouting program and rapid sucker multiplication techniques in Nkhatabay (Malawi), Idologun (Nigeria), Ambam (Cameroon) and Adjara (Benin), leading to an expansion of the mother gardens (1000 to 3500 mats (up to 10,000 suckers per year) and rapid growth of mats under pilot site member management. Pilot sites influenced establishment of additional mother gardens by communities working with the NARES. Seed flow studies conducted in the pilot studies informed banana seed systems as largely informal with farmers (men and women) sourcing seeds from other farmers for first establishment of banana fields and subsequent plantings were done using suckers extracted from their old fields. Seed sharing was mostly among relatives, neighbors and other members within the community. This knowledge provided vital clues to understand disease epidemiology and improving models for clean seed production and distribution in the BBTV affected communities.

MAIN ACHIEVEMENTS WITH GENDER AND YOUTH RELEVANCE

Studies on gender relevant subjects were conducted using tools and models standardized in CC2.1. Data collection tools tailored to be gender-responsive, i.e., identify varietal trait preferences of men and women farmers including aspects of intersectionality, such as age, ethnicity, marital status, etc. Tracked seed sharing behaviors of men and women farmers in the researched communities and characterized gender differentiated preferences for traits and men and women farmers' behavioral patterns in seed dissemination/sharing. Investigation on gender roles in varietal preferences and participation of men and women in banana seed systems revealed household banana production as collaborative effort with land ownership and planting site selection performed by men's activity but supported by women's knowledge and preferences. Seed selection was mostly done by women, yet men had better access to seed. There were no differences in the varietal preferences for men and women and the choice is influenced by market. Complimentary roles in banana production provide scope for negotiation, compensation and altruistic and non-monetary reward system within households. The cluster team attended the BMGF Gender-Responsive Researchers Equipped for Agricultural Transformation (GREAT) course on 'Gender dynamics in agriculture: implementation of BBTD management'. The course research was done in Cameroon and Burundi pilot sites and results submitted as a manuscript and presented in seminars (IITA Cotonou Station and in Bioversity International). Completed draft on gender norms and implications for banana recovery in BBTD affected regions in West Africa.

MAIN ACHIEVEMENTS WITH CAPACITY DEVELOPMENT RELEVANCE

The BA3.4 cluster puts high emphasis on capacity development from community to laboratory level through innovative ALLIANCE approach. In 2017 capacity development efforts focused on individual training of early career professionals (2), masters (2) and PhD (4) students and group trainings (1 course for 8 persons) to NARES for adoption and application of BBTV diagnostics and improved lab capacity in Nigeria, Benin and Cameroon. S Ngata (Cameroon) and D Adedeji (Nigerian) completed PhDs, and two new PhDs were enrolled: A Oresanya (Nigeria) and A Enoh (Cameroon) with study topics on characterization of *Musa*

germplasm for BBTV resistance and role of endosymbionts in aphid transmission, respectively. Alice Simbare in Nairobi and Jean Christian Nyi Bunzu in Kinshasa successfully defended MSc thesis. All students are drafting manuscripts, some which are under authors review, for submission this year. A Bonaventure and L Nkengla completed training on Gender and Seed systems under the GREAT. Demonstration visits to pilot sites were organized to farmers, extension workers, policy makers and donors to showcase production recovery methods. A survey questioner to assess the country readiness in exclusion of BBTD was applied in Latin America to create awareness and help preparedness.

The BA3.4 cluster technologies and protocols served as inputs to the projects funded by the BMGF (Nigeria and Benin) and FAO (Cameroon, Equatorial Guinea and Gabon) which are leveraging further benefits in the targeted communities.

The BA3.4 cluster team engaged with the CC2.1 cluster in developing and testing 'RTB Tool Box' for gender studies, characterization of banana seed systems and seed flows in the pilot sites. This highly successful partnership underscores the benefits of internal collaboration to achieve cluster mission.

2. MAIN GAPS AND CHALLENGES

The main challenges in 2017 were listed below. No changes were made to the workplan or implementation as team worked efficiently to accomplish planned tasks.

- Limited funds to effectively monitor and coordinate pilot sites established in Phase 1, especially in DRC, Gabon and Congo Brazzaville. Actions were relied on better communication through on-line. Bilateral funds in some alleviated this situation in other pilot sites. In 2018, budget will be increased for travel to support at least one monitoring visit by coordinating RTB partner.
- Need for effective scaling model to expand eradication and production recovery strategies in the BBTD-affected areas in SSA. Experts during the "RTB Scaling Readiness Workshop" held in Dar in March 2017 commented that the 'eradication and recovery model' is effective but multi stage implementation over a long period demands high commitment of several actors for successful implementation. Experts also commented that easy alternatives are not available to the complex BBTV challenge and without scaling problem can only get worse. Novel approaches are being considered for scaling readiness for desired outcomes.
- Need to improve management of data collected from various field surveys and gender studies for meta-analysis using 'RTB Tool Box'. Although similar protocols were used, raw data files were fragmented and comparative studies take long time for want of data organization. In 2018, a secure database will be hosted on BBTV ALLIANCE site for login based data submission and access to users.
- Need to define outcome indicators and generate outcomes from the cluster. During reporting it became clear about this need and RTB M&E Office provide guidance for improvement actions in 2018, including training workshop in May 2018 to articulate outcomes and indicators.

MEASURES TAKEN AND ADJUSTMENTS PROPOSED

Some of the corrective measures to challenges are indicated in the previous section. Major corrective measure in 2018 will focus on improving outcomes and scaling readiness

- Our team will participate in the RTB M&E workshop in May 2018 at IITA, Nigeria, to critically review Theory of Change and improve outcome statements and set quantifiable indicators. One of the major assumptions to realize outcomes is through securing funds for scaling. Advocacy and active engagement of our team resulted in bilateral funds from BMGF from Benin and Nigeria; and from FAO to central African countries. The project team will discuss ways to achieve this for other countries and plan to develop new scaling concept in the cluster annual meeting in the week of 18 to 22 June 2018 in Cotonou, Benin.

- We are planning to engage with scaling experts to evaluate 'scaling readiness' and develop a new model for scaling eradication and production recovery at farm, community and regional level. Fund raising efforts will be enhanced to attract bilateral grants and also submit a proposal for RTB Scaling Funding grant call later in 2018.
- Staff changes: Senior Entomologist and Cameroon and Gabon pilot site leader, Dr R Hanna (IITA) and the gender specialist, L Nkangala (IITA) concluded with IITA at the end of 2017 leaving a big gap in leadership and expertise. Advertisement for replacement of entomology is open but gender consultant will not be continued due to budget cuts. Stop gap efforts have been made with trained staff to continue BA3.4 activities in Cameroon and Gabon; and working closely with IITA RTB Gender Focal point to find alternatives to complete gender work, especially pending data analysis and reporting. Incumbent, L. Nkangala pledge supported and continues to offer inputs and guidance to the work for smooth transition. Every efforts are being made to minimize disruption to due to loss of senior staff.

3. PARTNESHIPS: ACHIEVEMENT AND CHALLENGES

List of Key External Partnerships

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

FP	Stage of research*	Name of partner	Topic of partnership
3	1	INRA (France)	Develop artificial inoculation system for phenotyping banana germplasm for BBTV resistance. Infectious clones of six segments of BBTV will be established for inoculating test plants through gold-labelled particle bombardment technique to overcome the challenges with aphid inoculations. A joint PDF recruited to work between INRA (M Pooggin) CIRAD and IITA on this aspect with co-funding from Agropolis Foundation.
2	1, 2	WUR	Development and use of Small N and Large N tools developed by C Almekinders for characterization of banana seed systems and seed flow studies in Pilot sites. Student projects under joint supervision of RTB partners and WUR.
5	2	University of Cornell (GREAT)	Collaboration with BMGF Gender-Responsive Researchers Equipped for Agricultural Transformation (GREAT) project to use tools and study designs to assess the household and community variety preference choices. To our members, L Nkangala and A Bonaventure Aman, are serving as advisory board members.
3	1, 2	University of Florida	Collaboration with the modelling team led by K Garett, to characterize seed degeneration due to BBTV and network analysis using Impact Network Analysis (RTB Tool Box). Outputs will contribute to improve designing of seed systems and seed replacement rate.

FP	Stage of research*	Name of partner	Topic of partnership
Training private partner	1	Global Partners	BBTD surveillance through remote imagery and drone mounted cameras.
Analysis private partner	1	Vito Belgium	Development of analysis pipelines of drone generated images for disease surveillance
National research partner	2	Fruit Crops Research Institute, ARC South Africa	BBTD diagnostics and vector host studies
EU partner	3	EU Office Lilongwe	Partnership towards a learning alliance for scaling out BBTD control in southern Malawi.

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

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

Name of CRP or Platform	Brief description of collaboration (give and take among CRPs) and value added*	Relevant for RTB FPs
RTB CC2.1	Collaborating in developing and testing 'RTB Tool Box' for seed system characterization, seed flows and seed degeneration modelling. The CC2.1 team includes a rich diversity of experts to hypothesize various scenarios and develop models for analyzing data collected from BA3.4 research and development activities. This partnerships is improving efficiency	2, 3
RTB CC3.1	Collaborating on aspects related to pest risk analysis and models for effective surveillance by infusing quick diagnostic tools and mobile app based reporting tools for BBTV developed in BA3.4. Further steps are enquiring use of AI based disease recognition tools for BBTV. Niche modelling studies to understand the effect of climate change on banana aphid and impact on BBTV spread.	2, 3
RTB D2	Collaboration in phenotyping methods for evaluation of transgenic banana and plants for BBTV and aphid resistance.	3
Genebank Platform	Sharing knowledge and tools (BBTV indexing tools) for Genebank international distribution of Musa germplasm efforts	3

*e.g. scientific or efficiency benefits

4. FUND RAISING

Small Grant: GREAT – Seed systems Bananas US$4200 (small grant for Cameroon); a similar grant of US$1500 was awarded to the Burundi pilot site.

5. INNOVATIONS[1]

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

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

Title of innovation (minimum required for clarity)	Corresponding output in MEL	Phase of research *	Partners involved	Geographic scope: for innovations in phases AV* or USE* only (one country, region, multi-country, global)
Recombinase polymerase amplification for BBTV detection	3.4.3.1	AV	RTB	Global
BBTV CDS surveillance and reporting mobile app	3.4.3.1	AV	RTB	Global
BBTV tolerant Musa varieties and hybrids	3.4.4.1	AV	RTB	Global

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