ICT4BXW

Citizen science and ICT for advancing the prevention and control of Banana Xanthomonas Wilt

Social Networks Analysis for ICT-based control of BXW in Rwanda

The ICT4BXW project is developing an ICT-based tool within an early warning system that provides [near] real-time georeferenced data on the incidence of BXW, for further visualization and pattern analysis, which can guide options for effective policies and/or measures to combat further spread of the disease. The project is adopting Social network analysis (SNA) approach to detect and interpret patterns of social linkages among actors, and to identify the potential entry point(s) for improved adoption of the target innovation (tool and system)

ICT + Citizen Science: an innovative way to combat Banana BXW

Banana in Rwanda, being a key crop in the livelihoods of smallholder farmers and occupying around a quarter of arable land, is threatened by Banana Xanthomonas Wilt (BXW), which has spread throughout the region resulting in production losses both at farm and national level. However tracking the potential outspread of the disease in order to set up prevention policies has been challenging since it appeared in the region.

The fast development of ICT globally, such as the increasing saturation of Wifi/Internet, Smartphones, and widely adopted social media, has profound impacts on information exchange and social interactions. At the same time, the ICT is enabling the advancement of citizen science, where citizens and stakeholders (as nonprofessional researchers) are involved in data collection, knowledge creation and exchange, data analysis and interpretation. Citizen Science can enhance societal relevance of research by fostering contribution of a wide range of stakeholders and generating "actionable" knowledge.

ICT4BXW

Combatting Banana Disease Through Digital Innovation

Social Network Analysis (SNA) is one of the tools which can be used to assess the farmers' interactions between diverse actors for better decision making regarding agricultural practices. Social network analysis evaluates the patterns of communication and knowledge exchange, thus the elicitation and description of social interactions and quantification of the impacts of the social interactions. This approach suggests that farmers cooperate, consult and exchange in regard to adoption of new technologies instead of acting individually. By this the project will develop a virtual communication platform to provide real time data on the geographical occurrence of BXW.

Case study sites

Two Districts Kayonza in the East and Burera in the North, contrasting in terms of climate and soil but both within the Banana producing areas, have been selected for this study. In each district, 2 villages were selected distinguished by distance to extension services.

District	Sector	Cell	Village	Number of farmers
Burera	Kinoni	Nkumba	Karambo	89
	Kinyababa	Kaganda	Murambo	97
Kayonza	Kabarondo	Kabura	Rubira	91
	Kabarondo	Rusera	Rusera	214
Total				491

Knowledge co-production with rural communities

This research seeks, with the introduction of ICT in social networks, to understand more about farmers' decision making in agricultural regarding BXW management. To do this, we collect social network information through 2-stage questionnaire survey, before and after the release of ICT tool. Social network data include to whom farmers have a connections especially from whom they got information and to whom they provide information regarding BXW prevention and control. In the first round of survey, a total of 491 farmers were interviewed over 504 farmers expected.

In each village 2 parallel focus group discussions (Men group and women group) were conducted and group members were selected considering at least 30% youth (under 30 years) participation. The group was composed by 12-16 banana growers. The facilitator characterized the group through raising hands and counting to see number of young and old in the group (reference made to 30 years old), the education level and ownership of phones separating group members having smart phones with those having basic phones. Farmers were asked to list characteristics distinguishing small banana growers from large banana growers with their respective characteristics. Farmers were asked to give information related to BXW history in the village including the year it has been observed in the village, the incidence during the highest incidence and the control measures taken in the village. Farmers were asked about the effectiveness of applied control measure(s) and their perceived reason for the prevalence of BXW in their village.
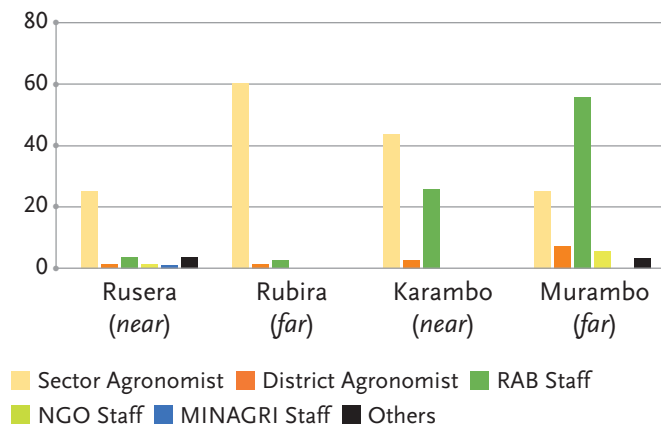
Figure 1 | Providers of extension services to farmers in last 2 years (Near village are village that are more accessible compared to far village taking into consideration of cost distance).

Figure 2 | Rusera farmers connections based on from whom they get information about BXW management.

Farmers were asked to list categories of people from whom they receive advisory services about BXW and categories of people to whom they report to about BXW happening in the village which was followed by pairwise ranking to identify the most important group. Tentative results show that sector agronomists are key players in formal extension systems as major source of advisory compared to other extension agents. In addition to this the location of farmers (Far, near and medium) reference taken from District extension offices is not likely to influence the extension services delivery. Figure 2 shows that local leader, farmer promotor and FFS facilitator, respectively by the order of importance, are the main provider of information related to BXW management.
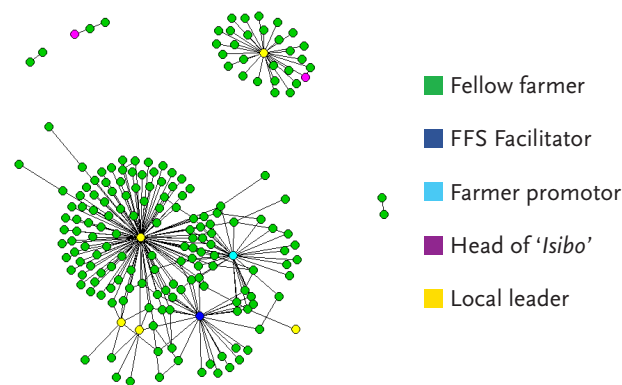
Participatory mapping: During participatory mapping, with the help of printed google image of the village on which important reference features like roads and forests are overlapped, farmers were asked to delineate banana plantations before BXW occurrence, location where BXW infected with their respective incidence, if possible the increase and the decrease of BXW in time and space, uprooted and renewed area and current situation of Banana plantations with location where BXW is present.

Participatory Mapping: This involve mapping every banana fields attributed to every farmer in the study villages.

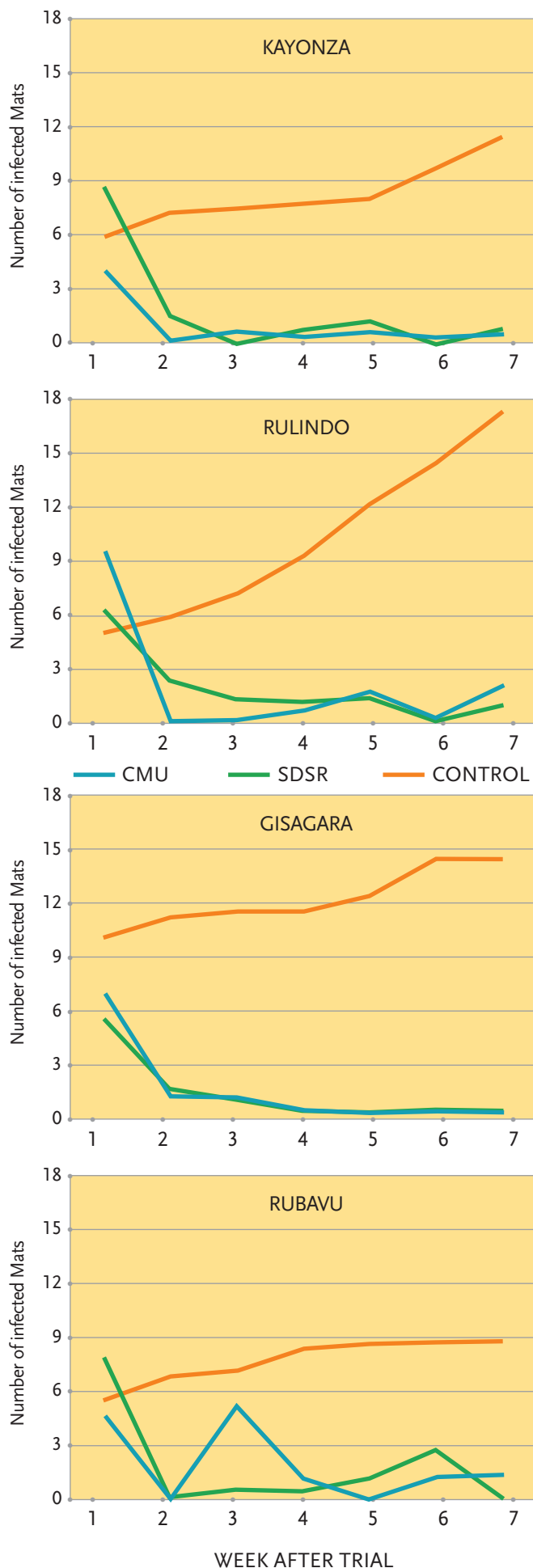## ICT4BXW project featured at International Green Week Berlin

The ICT4BXW Project was in the spotlight at the 2-week long International Green Week (IGW) Event in Berlin, held between January 17th and 28th, 2019. The IGW is organized annually to showcase innovations, products, and services that are existing and emerging within the Agricultural Sector, especially in Germany. Considering that over 400,000 visitors and exhibitors (mostly German nationals) participate in diverse events during the IGW week, it is considered as the largest agricultural festival/exhibition in the world. Along with other major projects funded by the German Development Corporation (GIZ), ICT4BXW was showcased as one of the frontline projects focused on advancing digital agriculture in Africa. In order to engage the audience with coherent message, ICT4BXW project team collaborated with the organizing Team from GIZ to produce a short video clip that summarized the problem that the project seeks to solve, the approach, and the anticipated impacts of introduction digital innovation for disease surveillance and management in East and Central Africa (Video can be accessed here). Also, the Project Leader (Dr. Julius Adewopo) honored the invitation to speak in multiple panel sessions (along with other speakers such as Dr. Kelemu from Icipe and Dr. Rabe from CIMMYT), focusing on the vision for digital agriculture in Africa.

Building ground level evidence for BXW control through SDSR Trials

Single Disease Stem Removal (SDSR) is a cultural management practice to control prevalence and spread of BXW disease in Banana farms. It involves cutting BXW-infected plant at soil level, sterilizing the cutting tools through thermal treatment (mainly fire), and early removal of male bud with a forked stick. Infected mats can recover under the combined effects of incomplete systemicity and latent infections. Under the ICT4BXW project, we have established and continue to monitor experimental field trials to generate ground-level evidence for effective cultural control of BXW disease through SDSR, with comparison to other approaches which are considered to be ineffective or uneconomical for the farmers. Across the 4 trial sites, plots where SDSR is implemented have consistently shown low BXW incidence level compared to the control plots. These trials will be used to facilitate evidence-based policy shifts by organizing field trips for relevant stakeholders and communicating results through policy briefs, in collaboration with RAB.

KAYONZA — Number of infected Mats vs Week after trial

RULINDO — Number of infected Mats vs Week after trial

Legend: CMU — SDSR — CONTROL

GISAGARA — Number of infected Mats vs Week after trial

RUBAVU — Number of infected Mats vs Week after trial

WEEK AFTER TRIAL

Unveiling beta version of BXW surveillance tool

In order to deploy a BXW surveillance tool and system that fully captures contextual realities and user-preferences, the project continues to follow a Participatory and Inclusive Technology Design (PITD) approach to design and test the envisioned tool. Sequel to the initial co-creation workshop for the surveillance tool (i.e. PITD-I; reported in Newsletter II), we have progressively developed the mock-up (i.e. prototype) and beta version of the smartphone-based BXW App (pronounced '*Box-Up*') and system.

PITD-II was held on Feb 3rd to 5th with focus on engaging selected sample of the next-users (i.e. Farmer Promoters) to evaluate and optimize the mock-up version, prior to the beta-version. Two major critical benchmarks were achieved at this stage:

1. Farmer promoters and sector agronomists were engaged in user-driven evaluation of the mock-up to finalize on user-preferences and matching of core functionality with users' needs

2. The Technical Development team received relevant inputs to align the content of the prototype with expectations and insights from Rwandan Agricultural Board - RAB (as the final host of the tool).

After a 3-month development process, the beta version of the tool was released for field pre-testing, and PITD III was held from May 6-8th. The same cohort of next-users for previous PITDs were reconvened to test the actual mobile applications on cellphone and with few farmers at 2 selected villages (Kinunga and Uruyenzi Villages). This field pre-testing enabled next-users to fully interact with various modules and content of the tool and generated useful information about the user-experience which support optimization of the beta-version of BXW-App before release for extended field validation.

Our Team of Experts

The ICT4BXW project is being implemented through collaboration of many experts and institutions and we showcase some of the researchers in each edition of our newsletter. In this edition, we present Dr. Inge Van den Bergh (Senior Scientist at Bioversity International) and Dr. Frans Hermans (Senior Researcher at Liepniz Institute, IAMO).

Dr. Inge Van den Bergh

Dr. Inge Van den Bergh is a Senior Scientist at Bioversity International. She is a great believer in the power of networking, sharing knowledge and exchanging experiences to advance science. As the coordinator of the knowledge-sharing network ProMusa (www. promusa.org), her goal is to make information and knowledge on banana accessible to scientists around the world and to promote scientific discussions on banana.

The ProMusa team, with the help of its members, has built a comprehensive resource on BXW. A general overview of the disease, with information about its distribution and spread, symptoms and management options, is summarized on the Musapedia page on BXW. Symptoms are further illustrated by a set of annotated pictures in the Musarama image bank, while Musalit brings together journal articles and other publications on the disease. The InfoMus@ section of the website keeps people up to date on the latest developments in the fight against BXW and explains related concepts, such as that of incomplete systemicity as the basis for BXW management.

As a partner in the ICT4BXW project, ProMusa strives to contribute to increasing our understanding of BXW and disseminating the available knowledge to farmers and extension workers, to help them manage the disease in their fields.

Dr. Frans Hermans

Dr. Frans Hermans is researcher at the Leibniz Institute for Agricultural Development in Transition Economies (IAMO) in Halle (Germany) where he is the leader of a junior research group ('Nachwuchgruppe') on The Role and Functions of Bioclusters in the Transition to a bioeconomy (TRAFOBIT). His research interests lie on the intersection of agriculture, sustainable regional development and innovation and transition studies. He applies both qualitative and quantitative methods in his research, ranging from Grounded Theory to Q-methodology and Social Network Analysis. Under the ICT4BXW project, he co-supervises Michel Kabirigi and provides support for the application of Statistical Network Models such as Exponential Random Graph Models and Stochastic Actor Oriented Models.

## Rwandan graduate student offered research scholarship

A competitive call for Rwandan Graduate Student was launched in the first quarter of 2019 to select interested and motivated students who will receive funding to conduct their graduate research under the auspices of ICT4BXW Project. Based on major focus on enhancing local research capacity through training of emerging researchers, major themes proposed include assessment of spatial distribution of BXW and ICT-based citizen science for control and prevention of BXW. Based on the 2-step evaluation process adopted, one student (Gilbert Micomyiza) finally emerged as a successful candidate out of a lean pool of interested students. He is a

2nd year M.Sc. Student from the Department of Geography at University of Rwanda. Within the next 6 months, he will be pursuing research theme related to spatial distribution of BXW within selected high-incidence districts in Rwanda. The scholarship (valued at $2,500) will cover costs of his research field work and support the completion of his M.Sc., while he is receiving co-supervisory guidance from researchers at IITA.

ICT4BXW Timeline
for the coming months

For the coming months the most important activities under the ICT4BXW project.
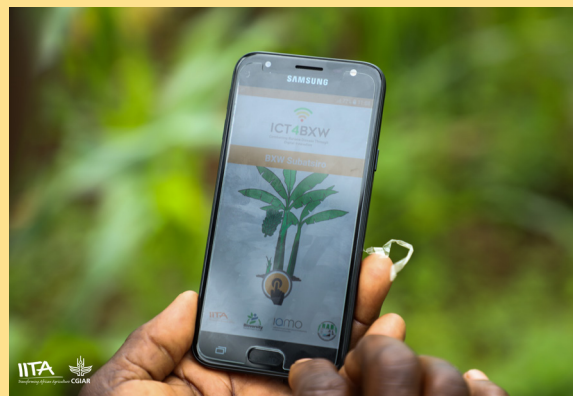
JUNE 2019
- Fine-tune Beta Version of BXW-App in Uganda with the ICT Consultant
- Prepare for District-level stepwise training of farmer promoters to use BXW-App tool

JULY 2019
- Commence stepwise training of farmer promoters to use BXW-App in 8 focal districts in Rwanda
- Conduct PITDIV in Kigali with Team Leads and supporting staff from RAB, MangoTree, and IITA
- Deploy beta version of BXW-App for field-level co-validation across villages

AUGUST 2019
- Facilitation and Backstopping of Framer Promoters for the co-validation of tool

SEPTEMBER 2019
- Backstopping and field monitoring of Farmer Promoters' for co-validation of tool

OCTOBER 2019
- Annual Planning Meeting with partners
- Field Visit to intervention villages

ICT4BXW

ICT4BXW Essentials

Timeline
2018-2020

Country
Rwanda

Lead organisations
International Institute of Tropical
Agriculture (IITA - overall lead)
Bioversity International
Leibniz Institute of Agricultural
Development in Transition Economies
(IAMO)

Main partner in Rwanda
Rwanda Agricultural and Animal Resources Development Board (RAB)

Implemented under
CGIAR Research Program on Roots Tubers and Bananas (RTB)
www.rtb.cgiar.org

Total Budget
€ 1,200,000

Donor
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
on behalf of the German Federal Ministry for Economic Cooperation
and Development (BMZ)

LED BY

IITA
Transforming African Agriculture

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RAB
RWANDA AGRICULTURE BOARD

IAMO
Leibniz Institute of Agricultural Development
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