

What is our idea?

Piloting ICT-based citizen science and decision-support tools for (cost)-effective and inclusive control and prevention of Banana *Xanthomonas* Wilt (BXW) in East and Central Africa.

Why is the idea unconventional, creative and why does it need to be funded?

Banana *Xanthomonas* Wilt (BXW) is a bacterial disease that affects millions of banana farmers in East and Central Africa. Neither effective treatment of infected plants nor sources of marketable disease resistant varieties are known today. BXW threatens food, income and nutrition security at farm and regional level. Its current management is ineffective as (i) practices are not tailored to local socio-economic and agro-ecological conditions, (ii) it depends on existing extension systems (rather than exploring alternative service delivery systems), (iii) it focusses on disease control rather than on prevention, and (iv) information does not reach end-users of different gender and age groups.

Today, 6 billion people have access to a mobile phone, more than the number of people that have access to a toilet. This provides enormous potential for big data collection through 'citizen science',

which can enable more cost-effective exchange of information and tailored and context-specific provision of services.

This citizen science project develops and pilots mobile (smart) phone-based data collection on incidence and severity of BXW in banana fields/ plantations in Rwanda. The geo-referenced data provided by farmers and other users enables personalized decision support on what would be the most (cost)-effective BXW control method (e.g. Single Diseased Stem Removal or Complete Banana Field Uprooting), taking into account the farmer's specific agro-ecological and socio-economic conditions (Figure 1). This citizen science system will provide 'big data' that feeds into a real-time GIS-based early warning system on BXW incidence, severity and spread, which will support governments in targeting their investments to prevent the further spread of BXW in the region (Figure 2). Participatory principles will be applied in



Figure 1 (left): Desired application for BXW control for smartphone (top) and basic phone (bottom).

Figure 2 (right): Desired early warning system based on heatmaps using GPS and citizen science data to monitor real-time BXW spread for BXW prevention.

designing and piloting the tools that build on (i) proven technologies such as ODK, USSD, SMS and voice messaging, and (ii) existing geographic, agronomic and social data on banana production and BXW.

We request INSPIRE funds to develop and pilot these tools in practice to generate proof-of-concept and enthusiasm that will convince governments and other scaling partners to invest in this approach.

Hypothesis and why the project will succeed?

Citizen science approaches and ICT tools enable the collection and use of geo-referenced data from extension providers and farmers to (1) provide more male and female farmers with tailor-made decision-support on (cost-) effective BXW control (at local level), and (2) develop a GIS-based early warning system to manage the further spread of BXW in East and Central Africa (at regional level).

This project will succeed because it is rooted in 10 years of solid scientific research by IITA and Bioversity International under the [CIALCA project](#) on BXW disease characteristics, spread, and what are effective disease control and prevention mechanisms (e.g. [Blomme et al., 2017](#)). CIALCA is acknowledged as an effective R4D partnership platform for innovation and scaling in East and Central Africa, and has credibility with key decision-makers. Moreover, the project builds on [ongoing citizen science research with Wageningen University](#) under the CRP RTB that facilitates integrated analysis of the BXW problem, and how citizen science, big data and ICT can support BXW control and prevention.

Implementation plan and performance within timeframe (12 Months) and budget (US\$100,000):

Implementation plan	Timeframe	Budget
1. Baseline and needs assessment of key private/ public scaling partners	Month 1	\$10,000
2. Participatory tool design of mockup of mobile (smart) phone application for BXW control, and GIS-based monitoring system of BXW spread	Month 2-6	\$30,000
3. Pilot and improve tools for BXW control with 50 extensionists/ (lead) farmers in main BXW affected regions in Rwanda, and test GIS-based data infrastructure and early warning system with government decision makers	Month 4-10	\$40,000
4. Launch mobile phone application for decision-support on BXW control as free download on the Apple App Store and Google Play	Month 11	\$5,000
5. Build partnerships and capacity in Rwanda to host and maintain the ICT-infrastructure (with NARS and mobile data providers)	Month 1-12	\$10,000
6. Develop science publication and communication products to sensitize regional scaling actors in Burundi, DR Congo and Uganda about proof-of-concept for regional uptake	Month 11-12	\$5,000

Essential data generation:

Information and communication needs of end-users (farmers) of scaling partners; data on BXW incidence, severity and spread patterns in the region; correlations between incidence and suitable control and prevention options at local and regional levels; user satisfaction and feedback data.

Post-pilot ideas and projections:

The project will take place in Rwanda, a country with a clear [ICT4Ag policy](#). Once proof of concept is generated, scaling partners from DR Congo, Burundi and Uganda will be involved. The project will lay the foundation for successful scaling by (i) engaging next-users, end-users and key scaling actors throughout the project, (ii) producing compelling scientific evidence, and (iii) developing communication products to convince scaling actors in neighboring countries to engage in collective action to scale the positive impacts on joint BXW control and prevention in East and Central Africa.