

Strengthening the capacity of the National Agricultural Research Systems (NARS) to sustainably manage the outbreak of Banana *Xanthomonas* Wilt in East and Central Africa

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Abstract

Since 2001 banana *Xanthomonas* wilt has seriously threatened East and Central African food and income security, with entire crop holdings being wiped out in some areas. In response, Bioversity International coordinated regional partners to develop a novel communications strategy to raise awareness of stakeholders along banana value chains, thus equipping them with the knowledge and skills to manage the disease and arrest its spread.

Activities were funded by USAID through the Catholic Relief Services (CRS) and the International Institute of Tropical Agriculture in the framework of the Crop Crisis Control Project (C3P) executed in Burundi; Democratic Republic of Congo; Kenya; Rwanda; Tanzania and Uganda from July 2006 to April 2008. CRS sub-contracted Bioversity to strengthen the capacity of the participating National Agricultural Research Systems to sustainably manage the wilt in each country. Bioversity engaged farmers, farmer organizations, extension-workers, local councils, NGOs, community-based organizations, universities, NARIs and the private sector to develop, test, disseminate and evaluate the tools for disease control in a coordinated communication strategy. The training employed an innovative onion-peel approach to deliver appropriate messages that addressed the needs of stakeholders, with more technical information given at regional and national levels, and reducing this to demonstrations and field visits at community level. Translations from English to French and to local languages increased community participation and gender sensitivity. Communication materials included a novel blend of: brochures; leaflets; billboards; clothing-slogans; radio talk-shows; drama; training workshops; CDROMs, and [posters](#) and [videos](#), as well as a bilingual website (<http://platforms.inibap.org/xanthomonaswilt/>). The campaign adopted a multi-disciplinary approach with multi-sectoral stakeholder participation along the banana value-chains. It adapted Participatory Development Communication, including “going public” strategies from NARO-Uganda, and ABCC (from HIV-AIDS campaigns) to advance the strategy in the six countries. The project facilitated sharing information and technology across national and cultural boundaries via stakeholder exchange visits, designed for the different contexts and needs. The campaign mobilized communities and their resources to arrest the spread of outbreaks by delivering information via seminars and workshops, and as radio and television talk-shows. Project activities were evaluated on 96 randomly but representatively selected farm-holdings that had been exposed to *Xanthomonas* wilt sensitization, training tools and associated messages across the 6 countries. Data on disease incidence and management competencies were collected from each farm and analyzed. Competencies doubled and consequently those applying the recommendations significantly reduced disease incidence vis-à-vis those that were not. The results showed that an estimated 51,000 farmers in target benchmark sites (or 153,000 acres) tripled their yields, achieving an estimated extra worth in excess of US\$ 67 million. This extrapolates to protecting a regional annual market value of around US\$0.75 billion, as well as enhancing regional food security and nutrition. At the sub-regional level, the rate of reported disease outbreaks went down by 20-40%. Stakeholders identified the need to develop more farmer-friendly methods for sterilizing tools as well as kits for the detection of latent infection to arrest long distance transmission. Other significant outcomes included bye-laws, local and national Action Plans for wilt control campaigns; partial disease eradication, and national budgeting for wilt control by some countries.

Introduction

The banana industry in East and Central Africa is a major contributor to regional food and income security. Since 2001, a new disease, *Xanthomonas* wilt of bananas, attained epidemic proportions in bananas and posed a serious threat to regional food security. By 2004, entire crop holdings had been

wiped out in areas where highly susceptible banana cultivars were dominating the farming systems. The Banana Research Network for Eastern and Southern Africa (BARNESA) appealed for resources to search for a solution to the problem. In Uganda an impact assessment study estimated that up to US\$4 billion could be lost by 2010 if no measures were taken to arrest the epidemic (Karamura, 2006). Subsequently, the International Network for the Improvement of Banana and Plantains (INIBAP) (now Bioversity International), in collaboration with the Food and Agriculture Organization (FAO) and the International Development Research Centres (IDRC) convened a regional stakeholders' meeting in February, 2005 and developed a strategy that envisioned multi-disciplinary, multi-sectoral approaches in a coherent regional response (Karamura et al., 2006). This took account of the countries/regions that were *Xanthomonas* wilt-free but threatened; the frontline areas where the disease had just arrived; and the endemic areas where the disease was already established. It also sought to raise the awareness of all stakeholders along the production-consumption chains and to provide them with knowledge and skills for the diagnosis and management of the disease. Importantly, it was realized that phenologically wilt-resistant banana cultivars could still be infected via contaminated pruning tools.

Hence, awareness-raising and associated training were seen as an integral component of the intervention strategy to control the epidemic and restore productivity in the affected banana-based farming systems. The spread of the disease can be significantly arrested by increasing farmers' and other stakeholders' knowledge and skills for diagnosis, spread mechanisms and control measures (Molina, 2006). Low cost management technologies developed by research institutions needed to be transferred to the affected stakeholders such as farmers, extensionists, researchers, policy makers at local and national levels as well as other chain actors in the financial markets, in the quest to marshal all possible support to address the problem. To do this required an innovative blend of communication strategies to be able to reach out to the target groups.

Objectives

The aims of the regional strategy were boosted when the Catholic Relief Services (CRS) and the International Institute of Tropical Agriculture (IITA) secured funds from USAID to execute the Crop Crisis Control Project (C3P) in an 18-month initiative to facilitate and intensify a coordinated fight against *Xanthomonas* wilt of bananas in six countries of Central and East Africa: Burundi; Democratic Republic of Congo (DRC); Kenya; Rwanda; Tanzania and Uganda (see figure 1). The overall objective was to strengthen the capacity of regional NARS to sustainably manage banana *Xanthomonas* wilt in the countries participating in the C3P. Bioversity, IITA and the NARS used the regional strategy developed in the framework of the BARNESA and the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA) to develop, test and disseminate *Xanthomonas* wilt diagnostic and management tools to stakeholders along the banana production-consumption chains.

The specific objectives were:

- To equip stakeholders with skills/knowledge/tools for sustainable management of *Xanthomonas* wilt at the farm level;
- To raise public awareness of the disease threat and appropriate control measures;
- To develop, evaluate, and disseminate information materials to stakeholders;
- To mainstream information on the ecology and management of *Xanthomonas* wilt of bananas in local and national level training institutions; ;
- To establish an early warning/surveillance system to facilitate timely response/actions against the *Xanthomonas* wilt epidemic;
- To strengthen farmer capacity to introduce and manage clean banana planting material of farmer-selected varieties;
- To evaluate on-farm, the effectiveness of the *Xanthomonas* wilt of bananas Diagnostic and Management tools;
- To facilitate the drawing up of national frameworks (Nation Action Plans) for the control and management of *Xanthomonas* wilt of bananas and other banana pests and diseases.
- To strengthen NARS linkages with regional (CIALCA, BARNESA) and international platforms (Bioversity International, IITA, ARIs).

Methodology

Trainers were trained at regional and country levels and community level trainings were back-stopped. The sub-project also deployed novel approaches for communicating its messages to target groups aimed at mass mobilization against the disease. Diagnostic and management tools and sensitization materials were developed, tested and disseminated. National level training produced trainers for community-based trainers who then trained farmers in disease recognition and management.

The sub-project also developed communication and public awareness tools, and organized appropriate exchange visits for farming communities and/or extension teams to gain field experiences and exploit synergies between NARS. Finally, sub-project effectiveness and impact were evaluated. The IITA and project country project managers (CPMs) collaborated in this capacity building initiative

The ‘onion-peel’ training concept adopted a level of technical content appropriate to each successive training tier, with the regional trainings having the most technical content. At regional and national level, Training of trainers (ToT), trainers were given electronic and hard copies of all the tools used in the training, so they could produce or modify training materials as need arose. The farmer-trainings were more of visual demonstrations of symptoms and management techniques than theoretical disease-management presentations.

Research and extension teams leading national level campaigns against *Xanthomonas* wilt were given specific training aimed at developing responses appropriate to the stage of the epidemic (disease-free, frontline and endemic regions) relative to crop phenology. Training accommodated for the needs and roles of farmers, extension providers and researchers and covered the use and management of ‘clean’ planting materials.

Each country team had different frameworks for training, developed according to disease pressure and existing levels of knowledge. In general, national level training of research, extension and policy managers involved four components:

1. An overview of pest and diseases in banana-based cropping systems, of their impact on the banana industry and of the concomitant potential for improvement in regional livelihoods.
2. A description of *Xanthomonas* wilt in bananas, its diagnosis, mechanisms of spread and its control, and a review of strategies to raise public awareness of the disease. Disease management strategies targeted the eradication of disease pockets and longer-term disease management.
3. Planning skills for sustainable integrated pest and disease control strategies, including developing national action plans and establishing farm demonstrations and other farmer-learning approaches. Field visits included demonstrations of symptoms and control measures, and a participatory critique.
4. Visits to research centres working against the wilt, and to private sector laboratories involved in the production and distribution of banana planting materials. This strengthened linkages and generated information and technology up-dates.

At the end of each tier-training, trainees developed and presented a training program for their respective target areas and subsequently published their training schedules to enable Bioversity to backstop the country level training. The back-stopping support included providing teaching tools, field demonstration of symptoms and control measures. It also provided opportunities for cross-fertilization of ideas and experiences from other countries with similar activities. At the end of the workshop, the back-stopping scientist facilitated a workshop review so that trainees were equipped to address the needs of the next level.

At the start, different NARS had different levels of capacity to manage *Xanthomonas* wilt. To address capacity-gaps, the project facilitated sharing cross-border information and technologies via research/extension/farmer teams exchange visits. Appropriate approaches were designed for the different contexts: the Rwandese/Congolese teams visited Uganda targeting farmer-empowering approaches; the Ugandan teams visited Tanzania to learn about stakeholder mobilization and to target policy makers; the Kenyans visited Uganda to learn skills for raising public awareness.

Communities including researchers, extension, local councils, universities and NGOs/CBOs, and their resources were mobilized to arrest the spread of any outbreak, by delivering information in form of seminars, meetings/workshops/barazas and as radio and television talk shows, in the quest to reach as

many people as possible. Public awareness of the disease was raised via posters, pamphlets, brochures, talk shows, drama, workshops/seminars video documentaries and field days. The aim was also to attract more partners and extra resources, and to exploit comparative advantages of participating partners. In order to track progress and assess impact and effectiveness, participatory monitoring and evaluation tools (see below) were developed through farmer-workshops:

- The two workshop locations were characterized by: representative banana cultivars and overall high disease incidence.
- A manual was produced in English, French and other vernacular languages (Karamura et al., 2008) and made available on the web and on CDROM.
- Posters (see figure 2) and brochures were tested, suggested modifications incorporated into final versions and then translated. Each country received 1000 posters (Francophones in French and Anglophones in English), along with the respective electronic versions. This enabled countries to translate the tools into languages of the target sites.

For each of the 6 countries:

- 2 disease-stricken districts were selected in similar ecological and / or equivalent geographical zones (12 districts in all).
- From each district, 2 X 25 km² were randomly selected (24 sites in all)
- From each site, 4 farms were randomly selected.(96 farms in all)
- All the sites selected had been exposed to *Xanthomonas* wilt sensitization, training tools and associated messages.
- Data were collected by extension staff manning the district and/or the sites as specified in table 1, and analyzed using SPSS and means separated using a chi-square test.

Table 1: Data collection in C3P project

Data type	Data characteristics	
Competence levels to recognize and manage the disease:	Capacity to distinguish between <i>Xanthomonas</i> wilt and Fusarium wilt	
	Farmer's ability to recognize <i>Xanthomonas</i> wilt symptoms:	male-bud
		bunch
		within plant (sectioned banana fingers & pseudostems)
	Farmers' knowledge on disease	development (how <i>Xanthomonas</i> wilt enters and develops within plants)
		spread (plant to plant, mat to mat, location to location)
management (de-budding; disinfection of tools and destruction of infected materials; setting up an efficient surveillance system, use of clean planting material and other phytosanitary measures.		
Numbers of:	XW task forces formed at different levels	
	participants trained	
	organizations participating in the fight against XW	
Baseline data of disease incidence & distribution levels	When sites were established.	
	4-6 months later (on disease incidence on farm)	

Outcomes

The training reached 51,400 people (7 times the original target size). This was partly because bananas and this threatening disease are important to regional livelihoods, and partly due to the project

mobilization. Conversely, it was also observed that in a few sites farmers did not readily adopt recommendations that included high short-term losses via plant destruction.

Training evaluation showed that farm competencies gained were very high (60-100%) for disease symptoms and control measures, although farmers could not explain the various disease spread mechanisms. Similarly in all countries, farmers were effectively applying two of the first-line-of-defence recommendations (de-budding and destruction of infected material) but sterilization of infected tools remained a problem, even though this is shown to be the most effective means of disease control. This was attributed to poor implementation of current recommendations due to the constraints of flaming the contaminated tools in fire, where fire-building is constrained, or to the expense and scarcity of bactericidal chemicals in local markets.

In conclusion, strengthening the capacity of stakeholders, especially at the grass-root level, significantly reduced *Xanthomonas* wilt disease incidence on farm. Those applying the recommendations had 4-6 times lower disease incidence than those that were not (see figure 3). The results showed that the 51,400 trained farmers in target benchmark sites tripled their yields, achieving an estimated extra worth in excess of US\$ 67 million. This extrapolates to protecting a regional annual market value of around US\$0.75 billion (at the time), as well as enhancing regional food security and nutrition. At the sub-regional level, the rate of reported disease outbreaks went down by 20-40%. Stakeholders identified the need to develop more farmer-friendly methods for sterilizing tools as well as kits for the detection of latent infection to arrest long distance transmission. Other significant outcomes included bye-laws, local and national Action Plans for wilt control campaigns; partial disease eradication, and national budgeting for wilt control by some countries.

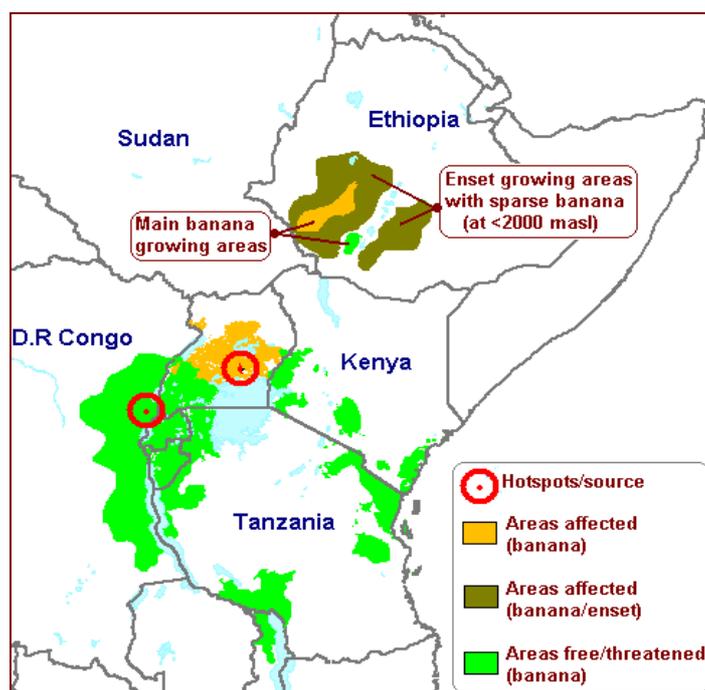


Figure 1: Project Area.



Figure 2: Farm level *Xanthomonas* wilt diagnosis and management posters

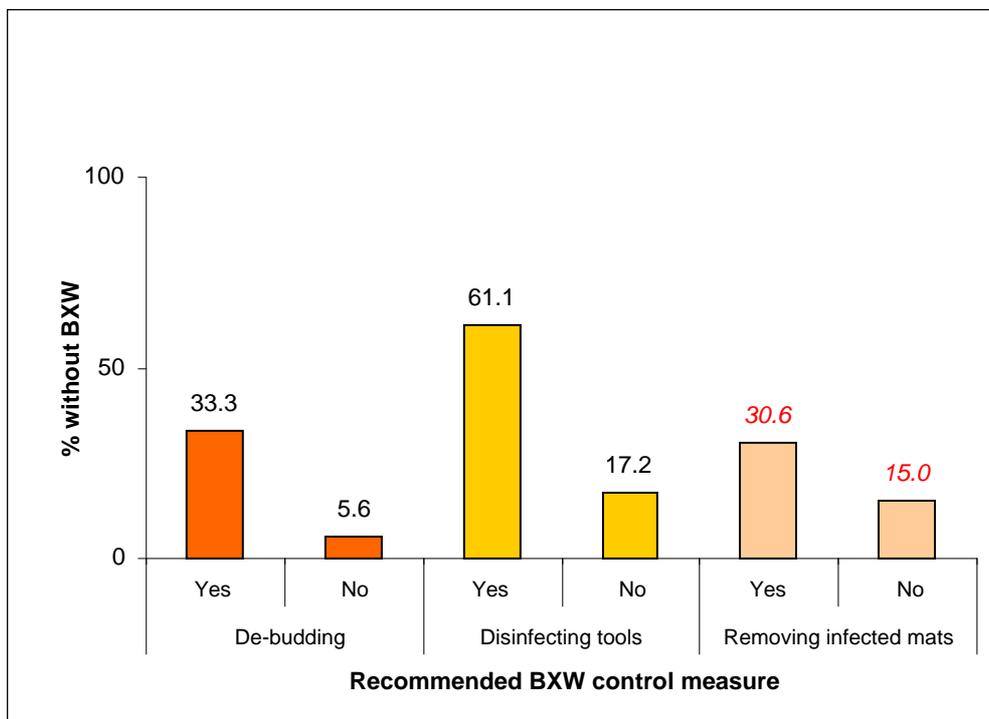


Figure 3: Effect of C3P awareness-raising on BXW control levels

[Figures in red italics are not statistically significant]

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