

# Policy Briefing

## Innovative biocontrol to combat Rwandan soil insect pests



The AgriTT programme is an innovative trilateral initiative between the UK Department for International Development (DFID), the Chinese Government, the Governments of Malawi and Uganda and the Forum for Agricultural Research in Africa (FARA). The programme facilitates the sharing of successful experiences in agricultural development with developing countries to improve agricultural productivity and food security.

The AgriTT Research Challenge Fund supported two year research projects to generate new thinking and practice on technology transfer and value chain development. Each project had a Chinese, UK, and African or South-East Asian research partner.

### Building in-country capacity to identify, mass-produce and apply native biological control agents

**In Rwanda, severe outbreaks of soil insect pests have been devastating many vegetable and tuber crops since 2011.** With one of the highest population densities in Africa and an influx of refugees from neighbouring countries, land and resources in Rwanda are stretched, so any threat to agricultural production has serious effects. Controlling pests hidden in the soil is especially challenging as they are difficult to detect. Rwandan smallholder farmers have limited access to plant protection products; and where pesticides are used, they are often highly toxic. The pests – which include white grubs (Scarabeid beetle larvae), cutworms (*Agrotis* species) and bean flies (*Ophiomyia* species) – cause losses throughout the value chain, threatening individual livelihoods and national food security. Poor yields result in higher food prices, and damaged produce has a poor shelf-life due to secondary infections. In response to the outbreak and the concerns of the farming community, the Rwanda Agricultural Board (RAB) and Ministry of Agriculture (MINAGRI) requested assistance with soil insect pest control.

**A team from China, Africa and Europe worked with the RAB to provide low-input, environmentally friendly and economically sustainable plant protection for soil pests.** This biologically based method involves identifying species of locally occurring nematodes (tiny threadworms) which selectively parasitise and kill particular species of soil-dwelling insect pests. These beneficial (entomopathogenic)

nematodes, which occur naturally in the soil, can actively seek out and infect a broad range of insects, but do not infect birds or mammals. Once such nematode species have been identified, they can be mass-produced for application on farmers' fields.

**Systematic surveys on the socio-economic status of households, agricultural markets, and existing knowledge on soil insect pests and their impact were carried out in three of the five Rwandan provinces included in the study.** Each geographical region has its own soil insect-pest complexities due to different landscape and cropping systems; and biocontrol solutions have to be tailored to these. The project's research focus, capacity-building approach, integrated pest management (IPM) strategy, and dissemination activities were all adapted to the results of these surveys. All key stakeholders were involved in activities throughout the project and beyond. The project worked with the research, extension and legislation branches of the RAB, the legislative, planning and decision-making bodies of MINAGRI, farmers and farming households, local agricultural district offices, and educational institutions such as the University of Rwanda.

**Chinese methods for mass-producing beneficial nematodes for soil pest control were successfully adapted to local conditions in Rwanda.** The first ever nematode-based biocontrol agent mass-production facility for soil insect pest control in Rwanda was established at the RAB southern division station in Rubona, and supported by rigorous hands-on training. Beneficial nematodes were successfully isolated from Rwandan soils for the first time in the country, and



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screened for their virulence towards target soil insect pests. Of nine local nematodes found (*Steinernema* and *Heterorhabditis* species), four were identified, maintained, screened and mass-produced, alongside three international nematode species. Over 3.5 billion beneficial nematodes have been produced per cycle by the facility, supported by a quality control strategy. While government support of research is ongoing, the facility is continuing to culture beneficial Rwandan nematodes to meet the RAB requirements for small-scale field testing.

**To bring the research into use, locally adapted application methods were jointly developed and publicised** through stakeholder events, including six research field trials and four farmer demonstration events. Information was disseminated through technical publications as well as posters and videos, which were further publicised through local and national press, online news, websites, radio and TV.

**Field application trials indicate 20–30% prevention of damage and losses to vegetable and tuber production caused by soil insect pests.** Thus nematode-based biocontrol could potentially stabilise yields and smallholder farmers' incomes,

while eliminating the adverse health effects of toxic soil pesticides by replacing them with safe beneficial nematode-based biocontrol products.

This trilateral project's focus on capacity building has successfully enabled Rwanda to:

- conduct research on soil insect pests and their biological control agents
- isolate and identify beneficial nematodes and screen them for biocontrol product development
- establish operational mass-production facilities for locally adapted biocontrol agents
- train local experts, technicians and farmers in the application of beneficial nematodes as part of a biocontrol-based IPM strategy for soil insect pests
- be in a position to develop national legislation for licensed and regulated local biocontrol agent production and application.

## Policy recommendations

- **Biocontrol agents may need product registration to proceed to commercialisation.** Like most of the macro-organisms that are used as biological plant protection agents, indigenous beneficial nematodes are still not regulated in Rwanda. As in some other countries, registration may not prove to be necessary, and the establishment of a biocontrol expert committee within the RAB and MINAGRI could address the level of need for legislation. This will lay the foundation for commercialisation of biocontrol technologies in the country.
- **The RAB and MINAGRI now have the capacity to maintain the entire production chain for beneficial nematodes,** from isolation through screening bioassays in the lab to field application and testing. Commitment and funding will be required to build on this foundation. In addition, the RAB is now in a position to conduct further applied research on nematode-based biological control and IPM in vegetables and other crops – for instance, information on soil insect-pest life cycles is limited, but is critical to the timing of biocontrol applications. There is also a need for training of more farmers and creation of more demand for biological control technologies and production across the country and the region. As a result of this international collaboration, the Rwandan partner and team members have the capacity to conduct this training and dissemination if additional financial support is forthcoming.
- **There is scope for synergies with existing programmes** such as CABI's Plantwise programme based on plant clinic networks (see [www.plantwise.org/plant-clinics/plant-clinic-locations/rwanda/](http://www.plantwise.org/plant-clinics/plant-clinic-locations/rwanda/)). If further work can be carried out to verify the findings, the project's IPM approaches to soil insect pest control can be included in technical factsheets and recommendations provided to farmers by local plant doctors (who also include key project team members from the RAB).



The new facility for biocontrol agent production is an essential step forward and serves as a model for future scale-up as well as a regional platform for research.



## Partners

### China

Institute of Plant Protection, Chinese Academy of Agricultural Sciences (IPP-CAAS), Beijing

Guangdong Entomological Institute (GEI), Guangzhou

CABI East Asia, Beijing

### Rwanda

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### Europe

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