



# Crossing Borders for IPM

The CGIAR Systemwide Program on  
Integrated Pest Management 2009 and 2010

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# Acronyms and abbreviations

AfricaRice	Africa Rice Center
APS	American Phytopathological Society
AVRDC	The World Vegetable Center
BBDT	Banana Bunchy Top Disease
BBTV	Banana Bunchy Top Virus
BXW	Banana <i>Xanthomonas</i> Wilt
CABI	CAB International
CCN	cereal cyst nematode
CEO	Chief Executive Officer
CGIAR	Consultative Group on International Agricultural Research
CHM	Crop Health Management
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CIRAD	French Agricultural Research Centre for International Development
CRP	CGIAR Research Program
DDG	Deputy Director General
DNA	Deoxyribonucleic acid
DON	Deoxynivalenol
DRC	Democratic Republic of Congo
EBRM	ecologically based rodent management
ELISA	Enzyme-Linked Immunosorbent Assay
EU-ACP	European Union cooperation with Africa, the Caribbean, and the Pacific
FAO	Food and Agricultural Organization
GIS	Global Information System
GPS	Global Positioning System
GTZ	German Agency for Technical Cooperation
HPLC	High-Performance (High-Pressure) Liquid Chromatography
HUB	Humboldt University, Berlin
ICARDA	International Center for Agricultural Research in the Dry Areas
<i>icipe</i>	International Centre for Insect Physiology and Ecology
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IITA	International Institute of Tropical Agriculture
ILCYM	Insect Life Cycle Modeling
IPM	Integrated Pest Management
IRRC	International Rice Research Consortium
IRRI	International Rice Research Institute
LFD	Lateral Flow Device
LMF	leafminer flies
LPB	legume pod borer
NARES	National Research System
NARS	National Agricultural Research System
NGO	Non-governmental organization
PCR	Polymerase chain reaction
SP-IPM	Systemwide Program on Integrated Pest Management
SPS	sanitary and phytosanitary
TLC	Thin-Layer Chromatography
WTO	World Trade Organization

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# Introduction

This report provides an overview of the evolution of the Systemwide Program on Integrated Pest Management (SP-IPM) of the Consultative Group on International Agricultural Research (CGIAR), during two years that brought positive changes to the Program but also led IPM to a decisive crossroads influencing its future in the CGIAR.

During the reporting period 2009-2010, the management team continued its efforts to reorient the Program to a broader, modern, and more interactive platform for IPM researchers of the international agricultural research Centers. The goal was to bring together those willing to collaborate across the borders of their institutions, and to make systemwide thinking the entry point into future IPM research within the CGIAR and associated Centers.

The report focuses on internal measures taken to improve operations and on the implementation of the research framework. It also highlights an expert meeting organized to discuss the latest methodological and technological advances in IPM and their suitability for small-scale farmers in developing countries to confront the increasing need for higher food production. It presents the outcome of that meeting, a White Paper, that advocates a broader, multidisciplinary approach to crop protection and provides guidance to research institutions, policymakers, and donor agencies on how to increase the impact of crop protection research. It also describes the measures taken to position IPM research and SP-IPM in the future CGIAR. In its annexes, the report also features a list of publications produced and events organized by SP-IPM scientists.

# Revitalizing SP-IPM

## Getting to know the SP-IPM family

The Chairman and Coordinator completed their round of visits to all member Centers by travelling to the headquarters of ICRISAT, AVRDC, and IRRI in January 2009. During the following month, the Chairman took the opportunity of another mission to pay a formal visit to *icipe* and meet the Director General and IPM staff to call for support to SP-IPM. The Coordinator concluded the visits to the member institutions with a visit to AfricaRice in Bénin in November 2009. The visits were very fruitful because the SP-IPM management team could establish personal contacts with scientists and Centers' management, and remind them of the benefits of active participation in SP-IPM. The Centers acknowledged the support received from SP-IPM but needed to see further tangible benefits now and in the future.

## Individual membership introduced

In late 2009, membership of SP-IPM was extended from institutions to individual scientists to increase their commitment to and benefits from SP-IPM. Until today, over 90 scientists of different relevant disciplines have subscribed as active members, willing to contribute in many ways to make SP-IPM a useful forum where solutions are developed to problems of pests and diseases in the crops of farmers in developing countries. Nevertheless, there is need to extend membership to scientists in other centers of excellence to enrich the team and generate new opportunities for collaboration.

## Executive Steering Committee established

To allow faster decision making and a quicker feed back to the Secretariat, an Executive Steering Committee was established in May 2009, composed of the Chairman, three Steering Committee members, and the Coordinator as the secretary. An Executive Steering Committee meeting was held in September 2009 and a full Steering Committee meeting in March 2010. Both followed other SP-IPM organized events that were taking place in Germany.

## Visibility increased

A new website was designed and launched that better serves the needs of the IPM community within and beyond the Program. The new site went online in December 2009 and links to other relevant IPM information sources for greater utility.

For better identification of specific expertise available within SP-IPM, a searchable expert database has been created and uploaded on the website with open access.

Beginning in 2010, a quarterly e-newsletter was launched, targeting SP-IPM members and partners, investors, and interested individuals and organizations. This newsletter features activities of the Secretariat and achievements of SP-IPM members; provides information about events and new and finalized projects; and allows members to introduce themselves and their work.



The new SP-IPM website went live end of 2009.  
[www.spipm.cgiar.org](http://www.spipm.cgiar.org)

# Implementing the research framework

In early 2008, the SP-IPM team agreed on a research framework for the future with three research thrusts that are supported by capacity building activities:

*Adaptation of IPM to climate variability and change*  
*Improving agroecosystem resilience for soil, root, and plant health*  
*Managing contaminants in foods, feeds, and the environment.*

To implement this framework, multi-Center project proposals were developed and submitted as a response to suitable calls from funding agencies. SP-IPM proposals are submitted by one of the member Centers on behalf of the collaborating partners. SP-IPM aims at enhancing inter-Center collaboration in IPM research; the Secretariat therefore encourages projects that are developed and carried out by multiple members. However, opportunities are limited since fund allocations by donors and the need for other partners to engage in the implementation do not allow a larger number of Centers to be involved in a particular project. This is a major factor limiting the generation of synergies among the SP-IPM member Centers.

Three proposal submissions were successful in 2009, and project implementation started the following year (Box 1). At the end of 2010, another two projects were approved. All these projects are funded by the German Government through the Federal Ministry of Economic Cooperation and Development (BMZ) and have a duration of three years.

These SP-IPM inter-Center projects complement research that is ongoing at individual member Centers.

## **New collaborative projects on the ground**

Together with other partners, a project on *Expanding the rational and biological control of invasive Liriomyza leafminer flies to major horticultural production systems of East Africa* is being implemented by the SP-IPM members CIP and *icipe*, the lead Center.

Current status: A planning workshop on 10-12 May 2010 marked the start of the operations of the project. In June, surveys began in Uganda and Tanzania to collect the baseline ecological information on the distribution of *Liriomyza* species and associated natural enemies in vegetable production systems, their incidence on different vegetables, and the areas at risk of higher infestation. *Liriomyza* samples have been taken at various locations in both countries and the identification of specimens to detect possible invasive species is ongoing. Important invasive species were found to be present in Uganda and Tanzania on crops such as tomatoes, French beans, cucurbits, peas, okra, and potatoes, with different levels of infestation on each crop. Laboratory colonies of these pest species are being maintained at *icipe* for further studies. The surveys have also generated information on the abundance and distribution of local natural enemies. Based on positive results regarding the establishment of the exotic parasitoid *Phaenotoma scabriventris* in the Kenyan central highlands, permission is currently being sought from the competent national authorities to extend the release of *P. scabriventris* to the mid-altitudes and lowlands in Kenya, Tanzania, and Uganda. Technicians from Uganda and Tanzania were trained in sampling leafminers and their parasitoids, their identification, and rearing procedure. Plant inspectors from all three countries received training in effective monitoring and surveillance of *Liriomyza* leafminer pest

species in vegetables. A technical brief and extension flyer were developed and distributed to aid identification and management of key *Liriomyza* pest species.

CIP is implementing a project on *Predicting climate change-induced vulnerability of African agricultural systems to major insect pests through advanced insect phenology modeling, and decision aid development for adaptation planning*. With *icipe* and IITA being among the partner institutions, two more SP-IPM centers are contributing to the project.

Current status: The project started on 1 March 2010. From 3 to 4 May, a planning workshop was conducted at *icipe*, Nairobi, with project partners from Bénin, Cameroon, Germany, Kenya, Peru, Togo, and Uganda. This meeting was also used to introduce project members and students to the application and use of the Insect Life Cycle Modeling (ILCYM) software. In the meantime, project positions had been filled and about 10 students have started preparing life tables of selected target pests and natural enemies. A project website has been prepared where information among project partners is shared. The ILCYM software is steadily updated with new features and improved possibilities for life table analysis and risk mapping. The project approach used to predict climate change-induced risks due to insect pests was presented recently at the international “Potential Invasive Pests Workshop” organized by the University of Florida, Miami, US.



Project partners at planning workshop in Nairobi. – J. Kroschel, CIP

The third project, led by AVRDC in collaboration with IITA, *icipe*, and others is on *Less loss, more profit, better health: reducing the losses caused by the pod borer (Maruca vitrata) on vegetable legumes in Southeast Asia and sub-Saharan Africa by refining component technologies of a sustainable management strategy*. Current status: A project planning workshop was organized at the end of May 2010 in Bangkok, Thailand, and the work plan was slightly revised. *Maruca* samples have been obtained from major host plants in Bénin, Kenya, Lao PDR, Taiwan, Thailand, and Vietnam for population characterization. The insects are being characterized, based on the partial gene sequences of the cytochrome oxidase I. The adult samples are also being collected for characterization based on the morphological keys. Two parasitoids (one each from Taiwan and Thailand) have already been collected and sent for identification. Collaborators in Laos, Thailand, and Vietnam are currently searching for more species-specific parasitoids. Collaborators at *icipe* have collections of pheromone compounds from female moths in Kenya and are expecting samples from Bénin and either Taiwan or Thailand. Collaborators at Humboldt University Berlin (HUB) have collections from Taiwan and Bénin; they are



Cowpea pods damaged by the legume pod borer, *Maruca vitrata*. – D. Coyne, IITA

awaiting collections from Thailand and Vietnam. Colleagues at *icipe* and IITA are screening several strains of entomopathogenic fungi against *M. vitrata*. Similarly, various biopesticides based on *Maruca vitrata* multiple nucleopolyhedrovirus and *Bacillus thuringiensis* are being screened at AVRDC.

## **Projects in the pipeline**

Provided that funding will be granted, SP-IPM will further increase collaborative research activities. Several concept notes and proposals have been prepared and submitted to different potential funders.

Two new three-year projects have already been accepted by the German Government for funding. These are: *Enhancing horticultural productivity, incomes and livelihoods through integrated management of aphid pests on vegetables in sub-Saharan Africa* led by IITA and executed in collaboration with *icipe* and AVRDC, and *Combating fruit flies and mango seed weevils through community-based implementation of a sustainable IPM program for mango in sub-Saharan Africa* under the leadership of *icipe* and in partnership with IITA.

These projects will be initiated in early 2011 to close existing knowledge gaps and develop technologies that help farmers to save more of their harvests and increase income opportunities.

## **Initiating new partnerships**

Developing and adapting technological innovations for farmers require partnerships with other centers of excellence that can add additional expertise and know-how to support the SP-IPM pool of scientists and thereby to achieve more significant research results. SP-IPM has always been keen in establishing partnerships with scientific institutes outside the CGIAR. Collaboration with the private sector, particularly the plant science industry, however, has been selective, and the mutual advantages of such partnerships have not been fully tapped.

To explore further opportunities of joint research projects that would fit into the SP-IPM focus areas the SP-IPM Secretariat organized a brainstorming meeting with six representatives of the plant sciences and food industry, and food retailers. SP-IPM was represented by the Executive Steering Committee members (J. Nicol, CIMMYT; J. Kroschel, CIP; A. Chabi-Olaye, *icipe*), Chairman, Coordinator, and Dr Bandyopadhyay (IITA) for his expertise in mycotoxins, an area where SP-IPM expects particular interest from the food industry. The meeting was hosted by the German Agency for Technical Cooperation (GTZ) in September 2009 at their headquarters. Two representatives of the GTZ Advisory Group on Agricultural Research and one from the Public-Private-Partnership Program also participated. The latter provided firsthand experience from successful collaboration in food production in developing countries between public institutions at the national and international level, and private companies, both national and multinational.

Opportunities for collaboration between SP-IPM and industry were identified in the field of mycotoxins management, especially deoxynivalenol (DON) and fumonisin toxins in wheat and maize. Shared topics were in the areas of (i) the improvement of agroecosystem resilience research on the combination of germplasm resistance with chemical and biological seed treatment to control pests, (ii) conservation agriculture with herbicides and appropriate machinery

### **Project descriptions**

#### **Expanding the rational and biological control of invasive *Liriomyza* leafminer flies (LMF) to major horticultural production systems of East Africa**

The project is a continuation of a previous inter-Center collaboration that laid the foundation for a regional biocontrol effort to bring to a halt the expansion of worldwide invasive leafminer flies, and reduce the associated huge losses in horticultural and food crops production, and the increasing pesticide use and environmental contamination in Africa and Latin America.

The purpose of the project is to improve the natural control of vegetable and potato leafminers in East Africa by building on existing experience in international agricultural research centers and to address jointly the identified research gaps to be filled to develop environmentally friendly approaches to manage LMF.

The activities cover the research-development continuum from country-specific collection of baseline data for the pest and natural enemy status, introduction, and release of exotic biocontrol agents, and the development and implementation of biocontrol-compatible integrated management that includes augmentative biological control strategies based on entomopathogens (fungi, nematodes) and the rational use of insecticides.

The expected outcome of this project is improved biocontrol of LMF in major horticultural and food crops and, more specifically, reduced pesticide use and an inferior pest status for LMF in the region, through the introduction of exotic parasitoids and other environmentally friendly integrated control methods in Kenya, Tanzania, and Uganda.

Funding: BMZ (€1.2 mio)

#### **Predicting climate change-induced vulnerability of African agricultural systems to major insect pests through advanced insect phenology modeling, and decision aid development for adaptation planning**

Through innovative phenology modeling and risk mapping, the project seeks to understand the effects of rising air temperatures caused by climate change on the future distribution and severity of major insect pests in important food crops in Africa. In the course of the project, the Insect Life Cycle Modeling (ILCYM) software developed by CIP will be further improved and adapted to a wide range of insect pests.

It addresses (i) the current knowledge gap about the effects from climate change on economically important insect herbivores and related natural enemies (parasitoids), especially in the tropics, (ii) the ability of African agriculture (farmers, national agricultural research institutions, policymakers, etc.) to cope with the risk of exacerbating and expanding insect pests due to climate change, and (iii) adaptation strategies to minimize crop losses caused by major pests.

The main expected outputs and outcomes of this project are (i) climate change-induced vulnerability of crops to pests determined through phenology modeling; a database on temperature-driven phenology models developed; computer-aided tools for pest risk mapping and adaptation planning improved and provided; (ii) scientists and IPM practitioners trained to use the project tools for country-specific pest risk assessments, adaptation planning, improving their pest management strategies, and providing information to policymakers to improve national pest management and quarantine programs.

Countries involved are Bénin, Cameroon, Kenya, Tanzania, and Uganda.

Funding: BMZ (€1.2 mio)

#### **Less loss, more profit, better health: reducing the losses caused by the pod borer (*Maruca vitrata*) on vegetable legumes in Southeast Asia and sub-Saharan Africa by refining component technologies of a sustainable management strategy**

The goal of this research is to improve the livelihoods and income generation capacity of small-scale vegetable legume farmers by developing a simple, economical, and environmentally sound IPM strategy for the control of the legume pod borer (LPB).

The project addresses (i) refining sex pheromones, (ii) developing newly identified entomopathogens into biopesticide formulations, (iii) evaluating their efficacy, alone, and in combination with other biopesticides and botanical pesticides which will act synergistically, and (iii) identifying species-specific natural enemies (parasitoids) of *M. vitrata* in Southeast Asia, believed to be its center of origin.

An IPM strategy based on sex pheromones, natural enemies, and biopesticides will be developed and validated in pilot sites in Southeast Asia and sub-Saharan Africa. In addition to the IPM strategy, molecular markers developed for characterizing the LPB populations will be made available to entomologists working on LPB worldwide, which will help them to characterize local *Maruca* species and/or populations. Newly developed mass-production techniques for natural enemies and entomopathogens will enable NARES, nongovernmental organizations, and the private sector to enhance their capacity to produce component technologies in sufficient quantities for wide distribution.

At the end of the project, farmers and consumers will benefit from increased availability of safer vegetable legumes. Animals will benefit from supply of safer vegetable legume fodders with reduced pesticide residues.

The target countries are Thailand and Vietnam in Southeast Asia, and Bénin and Kenya in sub-Saharan Africa.

Funding: BMZ (€1.2 mio)

in North Africa and West Asia, and (iii) good agricultural practices to conserve biodiversity and soil health while reducing pesticide use. Capacity development among national policymakers, researchers, and extension specialists to promote IPM strategies and allow a better assessment of risks from pests was an area where progress could be made. Capacity building could build on the existing courses developed by industry, however, with a stronger focus on biological control, ecological engineering, and other forms of non-chemical technologies.

After the strong expression of interest by the CAB International representative on the former SP-IPM Steering Committee and Inter-institutional Working Group to reinforce the relationship with SP-IPM, the Chairman and Coordinator suggested a meeting to explore how SP-IPM and the CGIAR in general could increase benefits from a closer cooperation with CABI while also contributing to CABI's mission and goals. The SP-IPM Secretariat was invited to the CABI Bioscience UK center in Egham to discuss with the CEO and a group of scientists.

CABI's publications are standard resources for most plant protection specialists. The Plantwise knowledge bank will be a new pool of comprehensive global knowledge on crops and pests, and build a surveillance system that allows pest risk forecasts, and mitigation and adaptation before pest outbreaks. The SP-IPM Chairman serves already on the user advisory board for the Plantwise knowledge bank. SP-IPM scientists could contribute content and provide feedback on the design and user friendliness of the database, thus helping to improve the tool while benefiting in their day-to-day work from its use.

# Bringing crop protection into the limelight

The world has become fully aware of the challenge to provide more healthy and nutritious food for a population growing ever faster when natural resources, such as water and land, are being rapidly depleted. The logical step to address the challenge is to secure the attainable yields existing by reducing or preventing the constantly occurring losses caused by biotic factors in the field and later during storage. IPM research and its implementation have achieved a great deal in the past, but not enough to avoid regular food shortages in certain regions of the world.

Despite many successes in the past, IPM scientists and practitioners are often confronted with the reality that they are having difficulties in making a significant and durable impact on the world's pest, disease, and weed problems. This is to some extent due to lack of adequate funding for IPM research. Many sceptics seem to believe the solution lies primarily in supporting resistance breeding efforts. Being a pro-poor, efficient, environmentally friendly, and sustainable foundation to reduce crop losses, plant breeding, like many other technologies, has made a significant impact. However, no single solution can solve all pest problems on its own. For many pests, no adequate sources of resistance have been identified or these could not be successfully incorporated into advanced breeding lines. Although the transgenic technology is considered to be important for pest control, to date, this technology has not yet made a significant contribution. Many pests are not manageable with host plant resistance alone and need additional IPM support. IPM is required to protect the sources of resistance presently available and to supplement situations where only lower levels of resistance or tolerance exist. In addition, crops do not suffer from one pest alone. Examples are abundant of cultivars resistant to one particular pest but susceptible to others far more difficult to manage. Food insecurity in the world is becoming more wide-spread therefore there is an urgent need for increased donor support to modernize IPM programs by adding new technologies to those already existing.

In the future, crop protectionists will be expected not only to reduce yield losses substantially to attain higher levels of food security, but will also be asked to solve food safety problems. The quality of agricultural products is being scrutinized daily. This problem is not limited to developed countries; farmers in the developing world also need to produce food with non-toxic levels of mycotoxins and pesticides. Humans living in less developed countries also have a right to healthy food.

Access to international markets by farmers of the poorer countries is seen as an appropriate means to foster development. However, to enter the global market place, farmers have to meet international standards of food safety and this fact is often overlooked. IPM can make a major contribution to help deal with this predicament.

In addition to its primary role of reducing crop losses, IPM is increasingly associated with the provision of other benefits, such as ecosystem services. Healthy, biodiversity-rich environments, culturally diverse landscapes, clean waterways, and watershed protection are services and public goods that IPM has to deliver. Managing landscapes through ecological engineering (e.g., push and pull, intercropping, relay and sequential planting, border strips, living mulches) is a valid way of improving livelihoods in areas where advanced technology is not affordable.

## **Expert workshop**

To brainstorm and develop a vision on how pest management can be improved to counter future problems in food security and food safety, SP-IPM gathered forward-looking experts with relevant disciplines from academia, industry, and civil society at a 2½ days workshop in Bonn, Germany

(3-5 March 2010). At the meeting, benchmark technologies were presented and their suitability for different target farmers was discussed. New approaches were explored to the development of innovative technologies, their adaptation, and delivery to farmers. The full workshop report (*Plant Health Management in a changing world – innovative pathways towards food security and food safety*) with all presentations and discussions is available on the SP-IPM website.



*Brainstorming on future pest management at the expert meeting in March 2010. – SP-IPM*

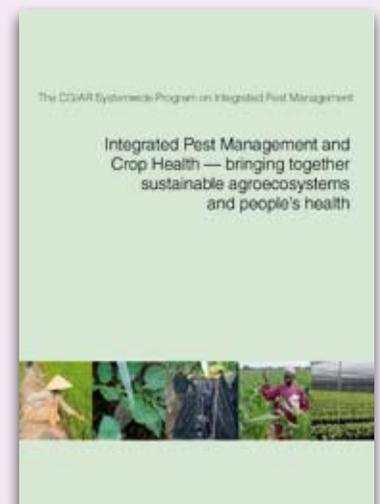
The findings formed the basis for the publication of a White Paper entitled *Integrated Pest Management and Crop Health – bringing together sustainable agroecosystems and people's health* (Box 2). In this White Paper, a call is made for a change in mindset. Addressing crop production, crop protection, and sustainable agriculture separately and delivering component technologies should be supplanted by integrated multidisciplinary approaches. This approach that includes IPM should aim at Crop Health Management (CHM) across crops growing in an ecozone. The move away from the isolated management of single pests on one crop towards CHM across crops and agricultural system performance is congruent with farmers' concerns and the broader pest situation in the field.

This change requires inclusive partnerships and collaboration among institutions and scientists who have their comparative advantages along the chain from development and adaptation to delivery and adoption of CHM technologies, thus ensuring the application and use of the latest scientific knowledge and technical advances.

The paper also points to the precarious situation of the available human capacity to develop, understand, and apply CHM. The multifaceted nature of CHM requires training and capacity development at many levels, from policymakers to national researchers, knowledge brokers, extension agents, and finally farmers. The paper suggests specific capacity building measures for different target groups with the ultimate goal of solving crop health problems by educating the people who are in a position to make an impact on sustainable food production.

The need for reforms of policies in support of CHM and of the extension systems to make them more effective is also tackled. Eventually, the White Paper makes a strong plea for higher and longer-term investments in CHM research which would allow better harnessing of the synergies of different players for a higher impact on the big problems, such as food security and safety, sustainability, and poverty reduction.

The document is addressed to the CGIAR Consortium, its research partners, donor agencies, and other institutions and organizations that work towards reducing poverty and hunger, improving human health, and fostering agricultural ecosystems. It sets out what is required to fully deploy the potential of modern CHM.



## BOX 2

### ***SP-IPM White Paper: Executive summary***

Improvements in Integrated Pest Management (IPM) can lead to sound crop health management programs that contribute to resolving the unprecedented challenge of food security facing the international community, particularly in the wider contexts of climate change, trade globalization, environmental protection, and poverty alleviation.

Harmful insects, fungal, viral, and bacterial pathogens, nematodes, rodents, and weeds – which are collectively referred to in this document as pests – are major constraints to agricultural production, productivity, and improved performance in agricultural systems. They cause chronic qualitative and quantitative losses of up to 40% of the attainable yield in major food and cash crops.

Further significant losses occur after harvest because of inappropriate storage methods that fail to protect the harvest from animal pests and pathogens. In addition, toxins caused by fungi in stored produce have a severely damaging impact on human and animal health, and are responsible for enormous losses for trade in global markets.

Reducing pre- and post-harvest losses caused by pests is a significant contribution towards improved food security and safety, and better market access. Traditional and modern pest management technologies need to be combined in new packages to operate in different socio-economic and ecological contexts.

Success in the near future requires a more balanced approach to the management of crop health and a significant improvement in the approaches and scientific methods of IPM used to address crop losses. There is a need to move away from isolated single-pest management towards crop health in general and an agricultural system performance that is congruent with farmers' concerns and with the broader pest situation.

Small-scale farmers in developing countries can participate not only in domestic markets but also in international trade by producing food at international levels of quality. They can increase their yields and the quality of their produce if given the proper tools for doing so.

Advanced pest management tools are presently not available for most of the farmers in the least developed countries because these have not been suitably adapted. Yet, many farmers have the ability and resources to implement modern IPM.

Because of recent advances in the specific field of plant protection, but also in a range of other scientific areas (agrophysiology, breeding, biotechnology, agronomy, economics, and sociology), IPM can produce definite outputs and outcomes with practical applications for improved crop health, sustainable agriculture, and global food security and safety.

Across CGIAR centers, however, there is a dire need for research to be strengthened so as to improve the established IPM methodologies while simultaneously making use of novel methods, such as pest risk assessment, crop loss modelling, precision agriculture, biotechnology, remote sensing, and decision theory methods.

Capacity building is needed to improve knowledge generally of what crop health is and how to adopt IPM innovations within the extension services and at the farmers' level. Conversely, national extension systems need support for their improvement and modernization to ensure the introduction and use of new IPM strategies and technologies so as to have an impact on the security of crop yield.

Substantial increases in food production can be attained relatively quickly by upgrading IPM strategies and linking them to the other sciences with an impact on crop health as a whole. This, however, requires adequate long-term financial investment in measures that reduce yield losses today. Investments that are limited to promoting agronomic and germplasm improvements, and targeted only at increasing yield potential, often ignore the fact that pests are causing massive losses now – losses that could be avoided.

## **Institutional visits and international events**

To promote SP-IPM and advocate for support to CHM research, the Chairman and Coordinator visited several international institutions and attended international meetings.

At the Asian Development Bank in Manila, The Philippines, in early 2009, they gave a talk to inform the audience about food safety issues, how these will be affected by climate change, and how they are addressed by SP-IPM. At the CGIAR 2009 Science Forum in the Netherlands, the Chairman talked about pollutants in the food chain and how they can be addressed by IPM research and better extension. In September 2009, the World Bank Development Research Group, together with the WTO Standards and Trade Development Facility, organized a seminar to discuss climate change and trade with a focus on sanitary and phytosanitary (SPS) risks. The Chairman participated and gave a presentation on how to address some of these risks. Also in 2009, the Chairman attended the High-Level Expert Forum *How to Feed the World in 2050* organized by FAO to remind the decision makers that biotic factors are a major cause of food losses. The Coordinator attended the sixth *International Integrated Pest Management Symposium: Transcending Boundaries*, 24-26 March 2009 in Portland, Oregon, USA, and presented a poster on global collaboration in IPM through SP-IPM. In August 2010, she made a presentation at a special forum on *Paradigmas y Evolución del MIP en el nuevo contexto agrícola*, held during the *XII Congreso Internacional de Manejo Integrado de Plagas* in Managua, Nicaragua. The Chairman represented SP-IPM in the Humboldt Forum for Food and Agriculture meetings, 2009 and 2010, where current and future world food needs were assessed and a roadmap for ways to eradicate undernutrition and food insecurity around the globe was discussed. The Humboldt Forum is a think tank in global agriculture of internationally recognized experts from science, civil society, and industry. Also present at these meetings was SP-IPM Steering Committee member, K. L. Heong.

# Steering Committee meetings

## **Executive Steering Committee meeting**

The newly established Executive Steering Committee met for the first time in September 2009 in at GTZ headquarters in Germany in continuation of the meeting with the private sector. Though the members of the Committee are in regular contact via electronic means, the physical meeting proved to be a useful way to discuss issues in more detail and evaluate the individual views of all members on the spot for immediate and coordinated decision-making.

The meeting decided to discontinue production of the IPM Research Briefs and replace them with 2-page-long concise Technical Innovation Briefs. The production of a quarterly e-newsletter was also recommended. The Committee also approved that scientists could become members of SP-IPM as individuals, apart from having institutional membership. The main topic on the agenda, however, was the structure, attendance, and funding strategy for the proposed expert workshop mentioned above. Finally, it was decided that a full Steering Committee meeting should be held on the occasion of this workshop scheduled for early 2010.

## **Steering Committee meeting**

Dovetailed to the expert workshop, a Steering Committee meeting was held on 6 March 2010 in Bonn, Germany. This was the first Steering Committee meeting since the current management team took office. The Coordinator gave an overview on the status of the Program in terms of members, finances, research projects, partnerships, unsolved issues, and the main activities of the Secretariat.

The DDG of the SP-IPM host Center, IITA, provided the latest information on the status of mega-program (now CRPs) development.

During the meeting, it was agreed to continue the tradition and to organize a symposium at the 2011 International Plant Protection Conferences. The suggested title of the symposium was *Crop Health Management for Food Safety and Agroecosystem Health in Developing Countries*.

# Publications

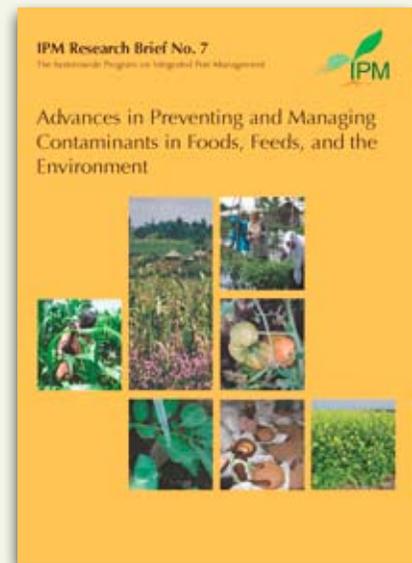
## White Paper

The White Paper *Integrated Pest Management and Crop Health – bringing together sustainable agroecosystems and people's health* has been described already in the paragraph on the expert meeting.

## IPM Research Briefs

2009 marked the end of the series of IPM Research Briefs because of the high production costs. One final issue has been published.

*IPM Research Brief no. 7: Advances in Preventing and Managing Contaminants in Foods, Feeds, and the Environment: examines some very different categories of harmful contaminants – pesticides, mycotoxins, microbes, and fertilizers – encompassing a wide variety of chemical and biological hazards with different origins, pathways, interactions, and effects but tied together by a common site of contamination, the agricultural field, and by their interlinks with pest management. The Brief highlights researchers, agencies, and regulatory bodies who are working on creative new solutions to contaminant challenges, leveraging a deeper understanding of pests and the ecology of the field. It describes how innovative IPM technologies are helping to make food safer for those who eat it, more marketable for those who produce it, and less harmful for the world as a whole.*



## Technical Innovation Briefs

The IPM Research Briefs have been replaced by short, easy to read electronic Technical Innovation Briefs which are produced more often and disseminate research outputs in a standardized format. In the first year, eight such Briefs were drafted by SP-IPM scientists and published by the Secretariat (Box 3).



In early 2009, the Secretariat published a biennial report on the Program *Towards a revitalized SP-IPM: The CGIAR Systemwide Program on Integrated Pest Management 2007 and 2008*.

In addition to these publications from the Secretariat, the SP-IPM scientists have published a large number of scientific papers, developed websites and produced videos. A list of selected materials is presented as an annex to this report.

### **BOX 3**

#### **SP-IPM Technical Innovation Briefs**

- Rodents – gnawing away at crops, stored grain and our health. SP-IPM Technical Innovation Brief 1. Singleton, G. (2010)
- Lost to the weeds – changing practices favor an old enemy. SP-IPM Technical Innovation Brief 2. Johnson, D., Casimero, D., Chauhan, B., and Janiya, J. (2010).
- Invasive floating water weeds – killing life and commerce. SP-IPM Technical Innovation Brief 3. Ajuonu, O., Tamo, M., Neuenschwander, P., Toko, M., Beed, F., and Hounkpe, C. (2010).
- Rid fruits and vegetables in Africa of notorious fruit flies. SP-IPM Technical Innovation Brief 4. Ekesi, S., Mohamed, S., and Hanna, R. (2010).
- Predicting the effects of global warming on insect pests. SP-IPM Technical Innovation Brief 5. Kroschel, J., Sporleder, M., Simon, R., Juarez, H., Gonzales, J., Carhuapoma, P., and Tonnang, H. (2010).
- Aflatoxins – the invisible threat in foods and feeds. SP-IPM Technical Innovation Brief 6. Bandyopadhyay, R. (2010).
- Sowing the seeds of better yam. SP-IPM Technical Innovation Brief 7. Coyne, D., Claudius-Cole, A., and Kikuno, H. (2010).
- A hot bath cleans all: Boiling water treatment of banana and plantain. SP-IPM Technical Innovation Brief 8. Hauser, S. and Coyne, D. (2010).

# Awards

## APS and Bioversity International awards for SP-IPM Chairman

In August 2009, the SP-IPM Chairman, Professor Dr Richard Sikora, was honored with the American Phytopathological Society's International Service Award. This recognizes his outstanding contributions to plant pathology in the world. He also received an award from Bioversity International in recognition of his contributions to the biological control of parasitic nematodes and soil-borne pathogens in banana and plantain. The award was presented by Bioversity's regional coordinator for Latin America and the Caribbean at the end of the Plant Health Management workshop in March 2010.



*SP-IPM Chairman awarded for outstanding contributions to plant pathology by APS. – R. Sikora, SP-IPM*

## Outstanding Promising Young Scientist

Jonne Rodenburg, AfricaRice Weed Scientist, was crowned with a prestigious international science award: Outstanding Promising Young Scientist. This award, for 2009, was conferred by the CGIAR at the Global Conference on Agricultural Research for Development, in Montpellier, France, in March 2010. It recognizes Rodenburg's commitment to helping resource-poor rice farmers in Africa, especially women, through the development of integrated approaches to managing parasitic weeds, the major source of yield loss in rice in Africa. He was particularly appreciated for his high-quality research, excellent record in publications, close involvement with building the capacity of national scientists, and successful efforts in mobilizing resources for research projects.



*J. Rodenburg from AfricaRice with his award certificate. – R. Raman, AfricaRice*

# Preparing for the future

The CGIAR reform, with the new CGIAR Research Programs (CRPs) becoming the future way of doing research and delivering outputs and outcomes, has been posing a challenge to SP-IPM throughout the reporting period. This has not only affected midterm planning and the active engagement of scientists but has also caused some donors to be reluctant to invest in SP-IPM.

It has been a concern for SP-IPM that research to develop new technologies for pest management might not be given the necessary importance in the reformed CGIAR. During the process of the development of the CGIAR's new Strategy and Results Framework, the SP-IPM Secretariat provided inputs into the various drafts of the document. With the support of the Executive Steering Committee, the Secretariat prepared a position paper to draw attention to the severity of crop losses and the need for the continuous development of appropriate IPM methods as a contribution to improved food security and safety. The paper called for increased consideration of IPM research in the new CGIAR. The Secretariat and many SP-IPM scientists also participated actively in the development of the proposals for the CRPs. Crop and yield protection, beyond germplasm enhancement to increase host plant resistance, will have its place in the CRPs. However, the future of SP-IPM in view of the forthcoming CRPs is not yet determined. No single CRP provides a logical home. Several, if not all, will have to include research on biotic stresses to achieve the objectives set. This will likely lead to a compartmentalization of crop health management research within the CGIAR Consortium. The SP-IPM scientists feel that in future they might be detached from one another and lose visibility within these big Programs should SP-IPM cease to exist as a forum for the exchange of experience and knowledge and as the linkage between Centers and crop protection scientists. The SP-IPM members see a continued need for a coordinating and communication mechanism also with regards to the outside world. To provide these functions within the future structural and administrative setup will be challenging.

# Financial Information

Summary of 2009 and 2010 donor contributions to the SP-IPM Secretariat (US\$)

<b>Donor/year</b>	<b>2009</b>	<b>2010</b>	<b>Total</b>
Switzerland	238,360	245,971	484,331
Italy	103,055	0	103,055
Germany	0	52,967	52,967
CropLife International	20,000	40,000	60,000
<i>icipe</i>	30,000	0	30,000
<b>Total</b>	<b>391,415</b>	<b>338,938</b>	<b>730,353</b>

# Annexes

## Events organized by SP-IPM scientists

### Rodent management

Dr G. Singleton and his team from the Irrigated Rice Research Consortium (IRRC) at IRRI held a training course on ecologically based rodent management (EBRM) 27-28 May 2009 at Barangay Belwang, Mountain Province, The Philippines. It was co-organized by the Social Action Development Center Vicariate of Bontoc-Lagawe, Mountain Province. The course started with a demonstration on how to set up rat traps in the rice terraces, fruit orchards, and the village. The formal training on the second day was attended by 115 farmers, who constructed a cropping calendar and recognized rice as their dominant crop. They identified rats as the most important factor limiting production. Individual farmers indicated losses of 10-50% from the harvest potential of rice because of rats. A lecture was given on the biology of the local rodent population, followed by a detailed decision analysis of the community's current rat-trapping methods. The participants were introduced to the benefits of synchronous cropping, good hygiene in the fields and houses, community action, and the community trap barrier system. The final part of the formal training included a workshop with 10 key farmers to formulate an action plan.



*Training on ecologically based rodent management by the IRRC team. – R. Rojas, IRRI*

Twenty participants from the Crop Protection Division of the Bureau of Plant Industry – Department of Agriculture attended the training course on *New Developments in the Management of Rodents* 16-17 March 2010, Los Baños, Laguna. The training course was organized and held by the IRRC team. The course helped bridge the knowledge gap on rodent management in the country and trained the participants on how to apply better management techniques with social, cultural, and ecological factors in mind. During the course, they learned the principles of EBRM; rodent breeding ecology in The Philippines; assessment of damage and yield loss caused by rodents; decision analysis, systems approach, and participatory research leading to community EBRM; and the social dimensions of a concentrated communication campaign against rats in Zaragosa, Nueva Ecija. A field visit provided a demonstration on how rodent traps are set in the field, an inspection of rodent damage to rice, and discussion on how to assess such damage, which is often overlooked unless it is at a high level. The participants then visited IRRI where they conducted hands-on training on species identification, key body measurements, and on determining the breeding history of female rats from necropsy.

### First workshop of the International Cereal Cyst Nematode Initiative

The Cereal cyst nematode (CCN) is acknowledged globally as a biotic constraint for wheat production, particularly under rain-fed conditions and drought stress. The first meeting of the International Cereal Cyst Nematode Initiative led by CIMMYT/ICARDA, was held from 21

to 23 October 2009 in Antalya, Turkey, and coordinated by Dr J. Nicol (CIMMYT). It involved over 22 countries and 60 scientists from wheat-growing regions in Asia, Australia, Europe, North Africa, and North America. It also featured over 50 scientific presentations in the areas of history and status of CCN both globally and regionally; research on CCN morphological, genetic and ecology diversity; development and deployment of host resistance as the principal means of control, including advancements provided by molecular technology; and investigations into other types of control and opportunities for integrated management. The papers provided valuable insight into the impact of CCN and endeavored to provide sustainable management options for farmers. The proceedings of the workshop have been published by CIMMYT.

### **Virus indexing training and awareness workshop**

From 26 to 28 May 2010, Drs L. Kumar, F. Beed, and T. Dubois of IITA held a virus indexing training and awareness workshop focused on banana at Namulonge, Uganda, for 32 researchers in national programs, plant health and quarantine bodies, and the private sector from Burundi, the Democratic Republic of Congo, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda. The 2-day workshop was fitted within a 2-week tissue culture training course, organized by the Uganda National Crop Resources Research Institute in collaboration with Makerere University and the Association for Strengthening Agricultural Research in Eastern and Central Africa. It focused primarily on cassava and sweetpotato. The use of tissue culture-derived planting material is becoming the mainstream in the region. The industry is largely private sector-driven, with increasing trade, especially for tissue culture bananas, between countries. This poses significant threats if no harmonized schemes are in place for indexing large quantities of commercially produced plants.

### **Training course on analysis of mycotoxins**

IITA (Drs L. Kumar and R. Bandyopadhyay) and the Nigerian Institute of Science Laboratory Technology conducted training on *Analysis of Mycotoxins* from 21 to 30 June 2010 in Ibadan, Nigeria. Objectives of this program were to (i) create awareness about mycotoxins and their management; (ii) acquaint participants with the modern laboratory techniques in the analysis of mycotoxins, particularly aflatoxins; and (iii) provide hands-on training to the participants in the application of ELISA-based approaches for the estimation of aflatoxins. The course had both the theory and hands-on training in sampling, sample extraction, and aflatoxins analysis by TLC, ELISA, HPLC, and LFD-strips. During the training session, participants were exposed to factors that contribute to mycotoxin contamination, the importance of monitoring and methods to estimate mycotoxin contamination at various stages from farm-to-fork. Twenty three participants from universities, research organizations and the private sector attended the meeting. They called on African governments to step up action against the spread of mycotoxins which are ravaging the health and trade of the people in the continent. The appeal was made in a communiqué issued at the end of the workshop.



*Attendees of the training course on Analysis of Mycotoxins held in Nigeria in 2010. – L. Kumar, IITA*

### **Awareness, surveillance and management of banana diseases workshop**

A workshop on *Banana Bunchy Top Disease (BBTD) and Banana Xanthomonas Wilt (BXW): Meeting the Challenges of Emerging Disease Threats to Banana and Strategies for Raising Awareness, Surveillance and Management of these diseases in sub-Saharan Africa* was held in Arusha, Tanzania, from 27 to 28 August 2009. This training workshop, organized by Dr F. Beed (IITA), focused on the state of knowledge for BXW and BBT, disease surveillance mechanisms, and data for use in controlling BXW/BBT where these are already established and to initiate a rapid response to eliminate infected plants where these diseases are just beginning to appear.

At the end of the workshop a joint statement was released to increase awareness of sub-regional organizations and national governments towards supporting a high level meeting in 2010. FAO requested IITA Uganda pathology to develop a proposal to perform training in disease surveillance for BBT and BXW in Uganda, Tanzania, Rwanda, DRC, and Burundi (see Disease surveillance workshop below).

### **Disease surveillance workshop**

Dr F. Beed (IITA) also organized a workshop on *Regional Disease Surveillance for Banana* for 35 people from Government Research, Extension, and Regulation from seven countries in Eastern and Central Africa (Burundi, DR Congo, Kenya, Rwanda, Tanzania, Uganda, and Zambia). The workshop took place on 25-29 January 2010 in Kigali, Rwanda. It featured training in disease surveillance including symptom recognition, GPS, and GIS; the collection of DNA from diseased plant samples using capture kits in the field and methods for PCR diagnostics in the lab; development of harmonized questionnaires for farmer surveys and characterization of field site characteristics; development of harmonized disease scores for BBTD; selection of targeted areas for disease surveillance of BBTD or BXW (or both) depending on the country. Logistics for surveys were determined, the use of DNA capture kits was explained, and these kits were handed out to participants from each of the seven countries. Linkages were strengthened between research and governments in each country and also among countries.

### **Planning to strengthen extension**

A workshop on *Development of a workplan to strengthen extension capacity in eastern DRC to cope with BXW and other agricultural production constraints* was organized by Dr F. Beed (IITA) in Goma, N Kivu, DRC, from 1 to 5 November 2010. The workshop had in attendance 85 people from government, extension, research, and development partners. It focused on current knowledge of BXW epidemiology and research opportunities to address knowledge gaps, extension mechanisms, partnerships, and coordination. It was an effective blend of theoretical and mind provoking presentations and participatory breakout sessions to harness collective wisdom on the priorities of what needs to be done, when, and by whom.

### **Training course in taxonomy**

A 5-day training course on *Arthropod taxonomy and identification* was held at Danzhou campus, Hainan University, Hainan Island, China from 9 to 13 August 2010. The training, organized by Dr K.L. Heong (IRRI), set three objectives and focused primarily on preparing participants to acquire (1) skills to identify the differences between arthropod orders and families; (2) skills to identify the major diagnostic features of the most common and important

arthropod orders, families, and species, especially of insects and spiders in the rice agricultural landscape using taxonomic keys; and (3) skills to handle and preserve arthropods for identification. The 16 participants were provided with a lecture series on distinguishing different arthropods, such as insects and spiders; on the proper collection, sorting, and preservation of arthropods; and on how to use taxonomic and picture keys. Trainees were taught hands-on preservation, the labeling of collections, mounting on paper card points and glass slides, and the preservation of larvae.

### **Training course on monitoring and surveillance of a quarantine pest**

Dr A. Chabi-Olaye of *icipe* organized a training course on *Effective monitoring and surveillance of quarantine Liriomyza leafminer pest species of vegetable crops in East Africa* for plant inspectors from 29 November to 3 December 2010. The objective of this training course was to strengthen the skills and knowledge of Plant Health Inspectorates in effective monitoring and surveillance of quarantine *Liriomyza* leafminer pest species of vegetable crops in Kenya, Tanzania, and Uganda with emphasis on export and domestic markets. It was a Training of Trainers course targeting a total of 14 participants from the three countries. The course participants were expected to share the knowledge gained from this training with their colleagues in their respective countries.

### **Training course in cost-effective aflatoxin control technologies**

Drs R. Bandyopadhyay and J. Atehnkeng of IITA, in collaboration with partners from the University of Natural Resources and Life Sciences, Vienna, Austria, organized two workshops on *Diffusion of Cost-Effective Technologies for the Control of Aflatoxin Contamination for Increased Health and Income* 11-23 April 2010 in Ouagadougou, Burkina Faso (25 participants) and 1-8 May 2010 in Nampula, Mozambique (34 participants). Presentations were made on the implication of aflatoxin on health and trade and possible management strategies in the field and during storage. Participants had the hands-on opportunity to determine aflatoxin from maize, cowpea, sorghum, and groundnut samples from the local market using the rapid test kit LFD strip. The participants were from the Ministry of Health, NGOs, NARS, farmers' organizations, and food processors.



*Aflatoxin determination during training course in Burkina Faso.*  
– J. Atehnkeng, IITA

### **Launch of Afroweeds**

Dr J. Rodenburg of AfricaRice organized a workshop to launch the EU-ACP funded project *Afroweeds*, a collaboration between AfricaRice, CIRAD, and NARS of 11 African countries. The project's primary objective is to create a network of partners from West, Central, and East Africa, and from Europe interested in sharing their knowledge through the application of computer science to agriculture and the creation of a knowledge database dedicated to identifying and managing major weeds in rice systems in humid zones (inland valleys and irrigated rice fields). The meeting was held in Cotonou, Bénin, 1-5 February 2010.

### Potato IPM project start-up meeting

A stakeholder workshop, organized by Drs J. Kroschel and M. Sporleder of CIP in Kathmandu, Nepal, from 24 to 26 November 2009, was the launching of the project *Development and application of ecological approaches in pest management to enhance sustainable potato production of resource-poor farmers in the Hindu-Kush/Himalaya region of Buthan, Nepal, Pakistan, and north eastern India*. This is funded by Germany and Austria to develop and implement ecologically safe approaches of pest management that enhance the sustainable potato production by resource-poor farmers in the mountainous regions of Nepal, Bhutan, Pakistan and India (Sikkim). The project will establish inventories of insect communities in potato agroecosystems and assess the efficacy of natural enemies. Since no effective natural enemies prevail in the region that could limit the expansion of the potato tuber moth (*Phthorimaea operculella*), the project implements classical biological control. For the control of *Liriomyza huidobrensis*, the current status of the pest and the possible adaptation of local antagonists that might affect the leaf miner population are under study. Additionally, the project aims to develop biopesticides and to test attracticides for eradicating the potato tuber moth in Bhutan. Molecular tools will be developed to identify white grub species and to monitor the establishment of released parasitoids. Some activities target alternative disease management technologies for late blight and wart. The project includes capacity building as well as participatory research with farmers.

### Establishment of Agro-Eco-Health Platform in Bénin

In 2010, IITA scientists Drs R. Djouaka, O. Coulibaly, and M. Tamo led the establishment of the *Agro-Eco-Health Platform* which brings together the Ministries of Health, Agriculture, and Environment, international organizations, NGOs, and funding bodies based in the Republic of Bénin and working on linkages between agriculture, environment, and health. On this platform, capacities were built and partnerships established for research on pesticide residues, environmental protection, and human health. A basic molecular and geno-toxicity analysis laboratory was established. Twenty young scientists from NARS were trained on molecular techniques used for investigating insecticide resistance in insects, and the effect of pesticides residues on non-target organisms, such as mosquito populations (malaria vectors) which breed in and around farms with a high use of synthetic pesticides. Trainings have also been conducted on the analysis of the chronic toxicity of pesticide residues found in water and soil samples and their implications for human health. As an alternative to synthetic pesticides, plant based insecticides are screened for their effects on both agricultural and medical pests.



Launch of the Agro-Eco-Health Platform in Bénin.  
– R. Djouaka, IITA

## Publications by SP-IPM scientists

### Scientific papers, books, and manuals

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## **Websites managed by SP-IPM members**

Web rodents: <https://sites.google.com/site/rodentmanagement/home>

Ricehoppers blog: <http://ricehoppers.net/project-news/>

Arthropods biodiversity: <http://hainanproject.org/>

## **Video**

Making African food crops safer – Aflasafe. <http://www.youtube.com/watch?v=bvZb2127aZk>

## SP-IPM member Centers and Steering Committee Members

### Centers

Africa Rice Center	AfricaRice
The World Vegetable Center	AVRDC
Bioversity International	Bioversity
International Center for Tropical Agriculture	CIAT
International Maize and Wheat Improvement Center	CIMMYT
International Potato Center	CIP
International Center for Agricultural Research in the Dry Areas	ICARDA
International Centre for Insect Physiology and Ecology	<i>icipe</i>
International Crops Research Institute for the Semi-Arid Tropics	ICRISAT
International Food Policy Research Institute	IFPRI
International Institute of Tropical Agriculture	IITA
International Rice Research Institute	IRRI

### Steering Committee Members at present

AfricaRice	Dr Francis Nwilene
AVRDC	Dr Srinivasan Ramasamy
Bioversity	Dr Charles Staver
CIAT	Dr Robin Buruchara*
CIMMYT	Dr Julie Nicol*
CIP	Dr Jürgen Kroschel*
ICARDA	Dr Amor Yahyaoui
<i>icipe</i>	Dr Adenirin Chabi-Olaye*
ICRISAT	Dr Hari Sharma
IFPRI	Dr Clare Narrod
IITA	Dr Ranajit Bandyopadhyay
IRRI	Dr Kong Luen Heong

### **Ex-officio members:**

Dr Paula Bramel (Deputy Director General for Research, Convening Center - IITA)

Prof. Dr Richard Sikora (Chair)\*

Dr Irmgard Hoeschle-Zeledon (Coordinator, IITA)\*

\* These members formed the Executive Steering Committee with effect from May 2010