Better tools, better harvests, better lives

AFRICAN AGRICULTURAL TECHNOLOGY FOUNDATION
ONDATION AFRICAINE POUR LES TECHNOLOGIES AGRICOLES

COMMITTED TO FARMERS

Field Testing Agricultural Innovations

ANNUAL REPORT 2010

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better tools, better harvests, better lives *mieux s'outiller pour récolter plus et vivre mieux*

Annual Report 2010. Committed to Farmers: Field Testing Agricultural Innovations

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Contributors: Hodeba J Mignouna, Nancy Muchiri, Francis Nang'ayo, Nompumelelo Obokoh, Sylvester Oikeh, Elhadj Moussa Adam, Gospel Omanya, Alhaji Tejan, Peter Musyoka, Grace Wachoro, Stella Simiyu-Wafukho, Amos Kimebur

Editors: Nancy Muchiri, Peter Werehire, Liz Ng'ang'a

Concept: Nancy Muchiri

Design and layout: Handmade Communications (design@handmadecc.co.za)

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COVER. This woman belongs to the Samburu tribe of Kenya. Necklaces like hers can weigh several kilograms.

INSIDE FRONT COVER. The copper rings, called *idzila*, around this Ndebele woman's neck indicate that she is elderly. She wears a head covering in a show of respect to her husband. This particular headdress is known as an *amacubi*, but they can also take the form of a knitted cap or a simple beaded headband. Married women wear *nguba*, a marriage blanket, decorated with beadwork to record significant events throughout the woman's lifetime.

Contents

Who We Are

The African Agricultural Technology Foundation is a not-for-profit organisation that facilitates public-private partnerships to access and deliver appropriate proprietary agricultural technologies for use by resource-poor smallholder farmers in Sub-Saharan Africa.

AATF provides expertise in identifying, accessing, developing, delivering and using patented agricultural technologies. The Foundation also contributes to capacity building in Africa by engaging institutions on the continent in the diverse partnerships through which it executes its mandate.

AATF is a registered charity under the laws of England and Wales and has been given tax-exempt status in the USA. It is incorporated in Kenya and in the UK and has been granted host country status by the Government of Kenya where it is headquartered.

Vision – what we want for Africa's farmers

Prosperous farmers and a food-secure Africa through innovative agriculture.

Mission – what we do for Africa's farmers

To access and deliver affordable agricultural technologies for sustainable use by smallholder farmers, in particular resource-poor farmers in Sub-Saharan Africa, through innovative partnerships and effective stewardship of technologies and products along the entire food value chain.

Core Values – what keeps us strong

We strive to uphold three enduring core values: Integrity, Dedication and Accessibility. These values guide our decisions, actions and relationships as we work towards fulfilling our mission.

Our Strategy

Facilitating public-private partnerships, technology stewardship and information and knowledge management are key aspects of our strategy. We anchor our activities within three strategic thrusts:

- Negotiating access to proprietary technologies that enhance the productivity of agriculture in Africa;
- Managing partnerships for project formulation, product development and deployment to introduce innovative agricultural technologies to African farming systems; and
- Managing knowledge and information to support technology identification and development, as well as helping create policy environments that are more conducive to smallholder agricultural development.

Our Roots

The model for the African Agricultural Technology Foundation resulted from two years of consultations by the Rockefeller Foundation and the Meridian Institute with several African, North American and European stakeholders.

The sessions, referred to as the 'Biotechnology Dialogues', were held to determine ways to close the growing gap between the agricultural science controlled by developed countries and the needs of the poor in the developing regions of Sub-Saharan Africa. The involvement of stakeholders in

MOZAMBIQUE. Mozambican dress reflects the merging of various cultures and also the wearer's economic status. Women who live in the rural areas still mostly wear the traditional dress called a *capolana*, an ankle-length cloth which is tied at the waist, and is worn with a matching blouse and hat. The white paste on this woman's face is known as the *musiro*, and only virgins or women whose husbands work away from home may wear it.

these deliberations was ensured through a Design Advisory Committee (DAC), comprising representatives from African national agricultural research services, the Consultative Group on International Agricultural Research (CGIAR) centres, African seed and biotech companies, the Organisation for Economic Co-operation and Development, crop science corporations, and donor organisations.

The DAC served as the architect of AATF, defining the major underlying principles and an operational model for the Foundation in addressing food security and poverty reduction challenges. The Committee also elucidated the core rationale for AATF and its fundamental principles, mission and business model.

Governance

AATF is a flexible organisation designed to respond to the changing needs of its stakeholders. The Board of Trustees charts the course by deciding which interventions hold the greatest promise for reducing poverty and increasing food security.

This creates a healthy separation between the setting of priorities and monitoring of progress on the one hand, and day-to-day management and operations on the other. AATF's Board members are distinguished individuals from around the world, while the Foundation's staff are all nationals of countries in Sub-Saharan Africa.

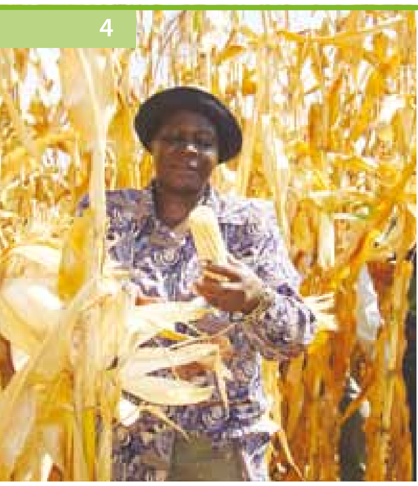
Investors

- *The United States Agency for International Development (USAID):* The agency responsible for providing and managing US economic and humanitarian assistance worldwide.
- *The United Kingdom's Department for International Development (DFID):* The UK Government department responsible for promoting economic development and the reduction of poverty globally.
- *The Bill and Melinda Gates Foundation:* Guided by the belief that every life has equal value, the Bill and Melinda Gates Foundation works to help all people lead healthy, productive lives. In developing countries, it focuses on improving people's health and giving them the chance to lift themselves out of hunger and extreme poverty. In the United States, it seeks to ensure that all people – especially those with the fewest resources – have access to the opportunities they need to succeed in school and life.
- *Howard Buffet Foundation:* A private foundation that primarily supports agricultural development and clean water delivery in rural areas, focused in Africa and Central America.

Partners

- Agricultural producers and consumers
- National and regional institutions and agencies (NARs, SROs, RECs, ECA, FARA, AU/NEPAD)
- International institutions/agencies (CGIAR, ARIs)
- Local/international NGOs
- Agricultural technology industry and public IP holders (Monsanto, Arcadia Biosciences, BASF, DowAgro, Pioneer/ DuPont, Syngenta, Academia Sinica)
- African trade and agribusiness organisations
- African governments

Highlights Year 2010



TOP TO BOTTOM: Jane Otadoh, WEMA-Kenya Regulatory team member, assists in the harvesting of the mock-trial in February 2010 at Kiboko.

Board member Kevin Natchtrab (left) chats with staff member Stella Simiyu-Wafukho during the 15th Board meeting dinner, hosted by the Board chair.

Dr Shadrack Moephuli, the Chief Executive Officer of the Agricultural Research Council of South Africa, gives his opening remarks during the WEMA regional stakeholder meeting held in Johannesburg in Apri 2010.

February

- The second WEMA Annual Review and Planning meeting is held in Maputo, Mozambique from 8-11 February. The meeting was attended by over 60 representatives from all WEMA partner organisations. The meeting was officially opened by Prof Eng Venancio Massinga, Mozambique's Minister for Science and Technology.
- WEMA-Kenya harvests its mock-trial planted in September 2009 at Kiboko, Kenya. Representatives from CIMMYT, Monsanto, AATF, the National Biosafety Committee (NBC) and Kenya Plant Health Inspectorate Service (KEPHIS) are present to ensure that the procedures for harvesting a confined field trial are followed.

April

- A regional training workshop to build capacity of tissue culture practitioners for efficient and effective mass micro-propagation of banana plantlets in the Great Lakes region of Africa is held at KARI-Thika in Kenya, bringing together public and private sector banana tissue culture (TC) practitioners in the Great Lakes region of Africa – Kenya, Uganda and Tanzania.
- The fifteenth meeting of the AATF Board of Trustees is held in Nairobi, Kenya, whereby a resolution is made that the AATF donors will have observer status during the Foundation's Board meetings.
- A WEMA regional stakeholders meeting is held in South Africa with over 70 participants drawn from different stakeholder groups including leaders of farmers' associations, heads of seed traders associations, members of parliament, permanent secretaries in ministries of agriculture and science and technology, biotech advocates, and media representatives, among others.

May

- The project to improve banana for resistance to banana *Xanthomonas* wilt (BXW) disease in Africa holds its inaugural project advisory committee meeting in Kampala, Uganda to review progress in product development, preparedness for confined field trials, resource mobilisation and management of key project components.
- The first WEMA transgenic trial is harvested in Lutzville, South Africa, in the presence of representatives from the Department of Agriculture, Forestry and Fisheries to monitor compliance with permit conditions.

July

- *Maruca*-resistant cowpea seeds of three transgenic lines are imported from CSIRO, Australia, for the Nigeria second trial of the *Bt*-expressing cowpea which was planted on 27 July 2010 at the Institute of Agricultural Research (IAR), Samaru.

August

- Scientists and technicians from institutes partnering with AATF in the *Maruca* resistant cowpea project – the Institute of Agricultural Research (IAR), Nigeria; the Savanna Agricultural Research Institute (SARI), Ghana; and the l'institut de l'environnement et de recherches agricoles (INERA), Burkina Faso – are trained on mass rearing of *Maruca vitrata*. The training aimed to empower the countries participating in the *Maruca*-resistant cowpea project to set up *Maruca* rearing facilities for a continuous supply of *Maruca* larvae for the infestation of the various events in the confined field trials (CFT). The training course, facilitated by AATF, was conducted by the Insect Rearing Unit of IITA-Ibadan.
- AATF, in partnership with IITA and the Kenya Agricultural Research Institute (KARI), initiates the process for the evaluation of aflatoxin bio-control technology in Kenya at Kampi ya Mawe, Katumani, Kiboko, and Bura in collaboration with the Kenya Plant Health Inspectorate Services (KEPHIS).
- The WEMA mid-term project review, involving all WEMA partners and teams, is conducted by Dr Greg Edmeades and Dr James Okeno, consultants appointed by the Bill & Melinda Gates Foundation with a goal to provide an independent assessment of the project's contribution and general health.

TOP TO BOTTOM: The WEMA team visits the Institute of Agricultural Research of Mozambique (IIAM) experimental site during the WEMA review and planning meeting held in Maputo, Mozambique in February 2010.

Participants to the WEMA regional stakeholders meeting held in South Africa in April 2010.

James Karanja, a Kenya Agricultural Research Institute (KARI) scientist, counts some seeds before they are planted.

- The first ever confined field trial (CFT) of transgenic *Maruca*-resistant cowpea planted in Africa is instituted in Nigeria at the Institute for Agricultural Research (IAR) on 25 August. This marks a significant milestone towards the development of *Maruca*-resistant cowpea for Africa.
- The AU-NEPAD African Biosafety Network of Expertise (ABNE) visited AATF in August for discussions on areas of possible collaboration. The meeting was a follow-up to one held between the two organisations in Burkina Faso in July. The Network is a continent-wide science-based biosafety resource for empowering African regulators with a focus on providing biosafety services to members of national biosafety committees, internal biosafety committees and plant quarantine agencies.

September

- The World Intellectual Property Organisation (WIPO) signs a memorandum of understanding (MoU) with AATF and accepts the Foundation as a permanent international NGO observer, which allows AATF to offer constructive and substantive contributions to the deliberations of the Assemblies of WIPO.

October

- A confined field trial to evaluate transgenic banana plants for resistance to BXW is planted on 5 October at the National Research Institute at Kawanda, Uganda, after approval is granted by the Uganda National Biosafety Committee (NBC).

November

- The Bill and Melinda Gates Foundation approves a proposal from AATF seeking US$ 200,000 funding support for the Open Forum on Agricultural Biotechnology (OFAB) – with country chapters in Kenya, Uganda, Tanzania and Nigeria – for a period of one year.
- The sixteenth meeting of the AATF Board of Trustees meeting is held in Dar es Salaam, Tanzania.

December

- WEMA Kenya institutes the first transgenic drought tolerant (DT) confined field trial (CFT) in Kenya at Kiboko on 1 December 2010. Participants from WEMA-Kenya, CIMMYT, Monsanto, AATF, Kenya's Ministry of Agriculture, and the Kenya Plant Health Inspectorate Service (KEPHIS) are present to witness and assist with the planting.

Message from the Board Chair

In the past several decades, the issue of food security in Sub-Saharan Africa (SSA) has remained central to major global discussions. This attention is stipulated by the continent's continued deficiencies in food production, and strongly reinforced by the intricate inter-relation between agriculture and other social, economic and developmental challenges in Africa.

The global deliberations have identified some key strategies towards food security in Africa such as the need for appropriate technologies, enabling policies in the agricultural sector, a change from subsistence to business models of farming and public and private sectors partnerships.

I am happy to report that on most of these points, AATF and partners made commendable progress in 2010. The Foundation's efforts to acquire and develop technologies that address the key farming constraints – insect and weed pests, diseases, drought and soil deficiencies – advanced commendably. The *Maruca*-resistant cowpea project continued to its second confined field trial in Nigeria. The transgenic banana lines being developed to resist the devastating banana bacterial wilt were tested in the first confined field trials in Uganda.

Commendably, the Water Efficient Maize in Africa project installed three confined field trials, in Kenya, Uganda and South Africa. Meanwhile, despite several challenges, the project partners were able to increase the seed production to control the notorious *Striga* weed. We also begun discussions in Kenya towards initiating a project on aflatoxin control. The research into rice that is nitrogen use efficient, salt tolerant and water efficient also progressed through various hurdles, putting it on schedule for confined field trials in 2012.

The accomplishments that AATF made in 2010 indicate the growing confidence that the regulatory agencies in the countries that we are currently working in have in science and technology. Our continued success is also emblematic of the good relations that the Foundation has cultivated with various governments and partners across the region and around the world. I commend the Foundation's management team and all our collaborators for their hard work.

Importantly, I recognise that these achievements depend on AATF's small, yet highly diverse and motivated staff, which contributes significantly to an enabling environment for the successful utilisation of science in development by providing the necessary information for decision–making at country level. AATF also provides and manages platforms for deliberations on key issues related to agricultural biotechnology. Through field visits and training, the Foundation also contributes to increased awareness of stakeholders on innovative technologies. All these efforts have enhanced the capacities of major players in Africa's agricultural development.

The Board urges AATF to continue sharing its knowledge and experience, to increase its regional integration efforts and to exploit new opportunities for the good of agricultural development.

Partnerships are at the core of AATF work and are the instrument through which the organisation seeks to deliver on its mandate. AATF therefore continuously seeks to work with others in all its endeavours. The Board is encouraged to note the continued mode of partnerships, providing a wealth of knowledge and depth of approach to AATF initiatives and projects. Building and maintaining effective partnerships is a complex endeavour and I would like to thank the Foundation's management for its skilful navigation as these partnerships continue to flourish. The Board is particularly happy to recognise AATF's acceptance by the World Intellectual Property Organisation (WIPO) as a permanent international NGO observer, a milestone that is an honour to AATF. Most importantly, it provides the Foundation with an opportunity to contribute to the deliberations of the Assemblies of WIPO. Further, the Board appreciates the organisation's efforts towards defining working partnerships with other organisations such as the Africa Union, the Partnership for Africa's Development (NEPAD), African Biosafety Network of Expertise (ABNE) and the Danforth Center.

We also had some developments at the Board level. In 2010, the Board elected Prof Ida Sithole-Niang, an Associate Professor and Head of Department at the University of Zimbabwe's Department of Biochemistry, as the new Chair-in-waiting to assume office in January 2011. Idah joined the Board in 2009 and has been the Chair of the Nominations Committee. The Board also elected Ms Josephine Okot as the Vice Chair. I congratulate both Idah and Josephine and thank them for accepting these important responsibilities.

The Board resolved to include a representative of AATF's donors as an observer during its meetings. The Trustees welcomed this move as value addition to their discussions on moving AATF forward. The Board welcomed new members including Prof Sir Gordon Conway, Dr Miriam Maiga and Dr Peter Matlon to the Board. The new members injected new experience, knowledge and energy to the Board especially given their understanding of AATF from its conception.

Challenges are a part of life and AATF faced some during the year. It is good to report that these challenges were not insurmountable and thus did not negatively impact AATF work although they provided good learning.

One key challenge is the regulatory environment related to research and management of transgenics. While many countries now appreciate the role that these technologies can play in addressing food insecurity, a number of them are yet to pass biosafety bills and the accompanying regulations. This is a cause of anxiety but I am glad to report that together with partners, AATF has been able to successfully work with governments to advance its projects within existing systems. In fact, I would like to note that a number of SSA countries have made tremendous effort towards understanding and progressing scientific research and they should be commended for this.

A second challenge was the resignation of the Executive Director of AATF at the end of 2010. The Board appointed Dr Hodeba J Mignouna, the Technical Operations Director, in acting capacity while it commenced the search for a new director. I wish to thank Dr Mignouna for accepting this additional responsibility that ensured the organisation continued fulfilling its mandate.

Overall, 2010 was indeed a busy year for AATF and, on behalf of the Board, I would like to extend the Board's appreciation to all our partners, investors, staff and friends. As the Chair of the Board, I also wish to thank my fellow Board members for their commitment and dedication to AATF. As I near completion of my term as Chair and Board member, I would like to urge you all to continue nurturing this organisation that offers great potential for Africa's food security endeavours.

Prof Walter S Alhassan
Board Chair

Message from the Executive Director

For AATF, 2010 was an exciting year. At the beginning of the year, we took time to collectively reflect on the journey we had travelled so far and what lay ahead based on the invaluable input and feedback from our diverse stakeholders. The feedback received covered our strengths and weaknesses, indicating to us what we were doing well, what we are not doing well enough, what else we should be doing and what we should improve on.

AATF commissioned a comprehensive reputation survey to seek stakeholder feedback on the services, communication, expertise, advice and guidance that we provide. The aim was to evaluate how our stakeholders see us and their level of satisfaction with our service quality and delivery and, as a result, make the necessary adjustments and improvements. I am pleased to report that the survey results gave a general rating of good to all AATF aspects measured. But what was most critical to us were the suggestions made on areas that needed improvement.

The knowledge and insights gained in the process are critical to the success of the Foundation, which largely depends on our ability to manage our partnerships with different stakeholders. Our activities in 2010 were therefore largely driven by the need to attend to some of the key issues that stakeholders pointed out to us, along with continuous feedback received in the course of our work including input from internal organisational development processes.

We consider our staff key stakeholders in ensuring that the Foundation fulfills its commitments to its constituents. During the year, the Board of Trustees approved the recommendations of a job evaluation exercise carried out by a staff-appointed committee. Management has started implementing the various measures recommended to ensure sustained fair pay and fringe benefits, career planning and development, manpower planning and linkage to rewards.

Another significant milestone in 2010 was the initiation of the development of a resource mobilisation strategy to address the short and longer term needs of the organisation. We found the goodwill from different donors quite encouraging. Some of them making direct commitments or expressing strong interest to fund the organisation and its activities in the future. We thank our current investors for their confidence in the organisation and continued support, which has strengthened our commitment to planning our future work.

In 2010, AATF significantly focused on creating awareness on and strengthening the critical elements that drive public-private partnerships (PPPs). During the 2010 FARA general meeting held in Burkina Faso, for instance, AATF organised a side-event in collaboration with the McLaughlin-Rotman Centre for Global Health at the University Health Network and the University of Toronto Canada to address the legal, ethical and commercialisation considerations that are central to trust building in these partnerships. The outcomes of the side-event were presented in the plenary session.

In addition, AATF and its partners undertook capacity strengthening activities through workshops, field visits, specialist involvement in activities and team experience-sharing that helped in project planning and implementation.

We continue to build our strength. To ensure projects received the technical support they needed, we widened our partnerships to include organisations with the experience that we felt was important to our work. We therefore worked closely with organisations such as the Danforth Center on product development and NEPAD's African Biosafety Network of Experts (ABNE) to support regulatory work.

We also paid attention to the larger operational environment especially in relation to technology regulation and understanding. AATF and partners undertook advocacy to promote information sharing and education through exhibitions, presentations at key meetings, the Open Forum on Agricultural Biotechnology (OFAB) and other activities. We believe our enhanced involvement will build on ongoing efforts and contribute to increasing understanding and appreciation of innovative technologies.

Agricultural biotechnology acceptance in Africa continues to be a challenge. However, I am glad to note that governments recognise, and encourage the critical role of science and technology including biotechnology, in their food security agenda. AATF will continue to provide support required by governments and their various organisations and institutions for safe use of biotechnology in agriculture.

In 2010, we also experienced some technical challenges with some projects – specifically in the development of the nitrogen use, salt tolerant and water use efficient rice for Africa and in production of sufficient seed quantities of the *Striga* control maize seed. It is however encouraging that project partners were able to come up with solutions to help move the projects forward.

Looking ahead, funding will remain a crucial issue for AATF. As our projects enter the critical phase of testing and commercialisation, funding requirements will increase and we would like to be able to ensure that the products are not delayed by lack of funds. Guided by our new strategy, we will pay considerable attention towards resource mobilisation in the coming years. AATF therefore looks forward to a busy 2011 as projects progress on schedule and require greater attention.

I wish to thank our partners and investors for supporting us throughout the year and especially the Board of Trustees for providing valuable guidance and support during the period. Special appreciation goes to the able staff members who have proven their commitment to the organisation and to Sub-Saharan Africa's smallholder farmer with their exemplary work that continues to steer AATF forward.

Dr Hodeba Jacob Mignouna
Acting Executive Director

Fighting *Striga* in Farmers' Maize Fields – Seed Production and Deployment Enhanced

In 2010, the *Striga* Control Project team increased its efforts towards greater seed production of IR maize, creating awareness and training farmers on the technology in Kenya, Uganda, Tanzania and Nigeria.

The *Striga* Control Project was launched in 2005 with the objective of increasing maize productivity in Sub-Saharan Africa by significantly reducing the infestation and the damage caused by *Striga* weed on smallholder farms. The project is in the deployment phase, focusing on stewardship and commercialisation of certified Imazapyr resistant (IR) maize varieties.

Seed production and distribution

During 2010, the *Striga* Control Project facilitated the production of 30 tonnes of IR maize seed in Kenya, up from the previous 20 tonnes available in 2008. Some of the seed was distributed to farmers through the agro-dealer network in western Kenya and also used for on-farm demonstrations. It is expected that entry into the project of two additional companies – Kenya Seed and Freshco Seed companies – to support efforts by Western Seed Company will result in further increased seed production.

In Tanzania, AATF facilitated the production of about 3 tonnes of certified IR maize seed TAN 222 under irrigated facilities by Tanseed International Limited. But these

LEFT: Extension officers from local NGOs evaluate a strategic roadside demo plot planted with IR maize (WS303) in Nyanza, Kenya.

RIGHT: Ms Aziza Awuor, an extension officer from Rachuonyo Farmers Association in South Nyanza, Kenya, evaluates an IR demo plot.

BURKINA FASO. Fulani women wear colourful, flowing robes that are richly decorated and embroidered. The coins that are attached to the clothing are often very old family heirlooms, passed down from generation to generation. The women also wear many bracelets on their wrists.

could not be sold as the herbicide was not formally registered for seed coating. Rather, Tanseed used this for further seed increase. The project increased its efforts towards registration of Imazapyr herbicide as a pest control product in Tanzania by defining terms of reference for engaging consultancy services. Registration will authorise the use of the herbicide in the treatment of certified IR maize for commercial use in Tanzania.

In Uganda on-farm variety trials were carried out to collect data that will support the ongoing national performance trials, seeking IR maize variety release and commercialisation projected for 2012.

In Nigeria, collaborative activities continued with the International Institute of Tropical Agriculture (IITA)-Ibadan, with the aim of multiplying more breeder and foundation seed of suitable IR maize hybrids and thus inch closer towards possible commercial release in 2012.

The CIMMYT office in Zimbabwe concluded regional trials, which provided data for identifying the best adapted lines for national

performance trials and potential commercial release in target southern Africa countries. However, no suitable IR maize varieties were identified in these trials. Further tests might be required to confirm IR maize entries that perform better than the local checks under *Striga* weed infestation.

Awareness and education

The project established 239 strategic IR maize technology demonstrations in 12 districts in Kenya. It also held 32 farmer field days to create awareness and promote knowledge transfer on agronomic characteristics, handling and use of the technology.

'We were innovative in our approach. We positioned our product demonstrations strategically by the roadsides, community markets, and along foot paths. This ensured they were easily visible and accessible,' says Dr Gospel Omanya of AATF who also coordinates the project at AATF.

Dr Omanya says that these demonstrations have been critical in enhancing awareness and interests of farmers and seed companies in the IR maize seed technology.

'The demonstrations are also useful in sensitising local government authorities and drumming up their support for mobilising communities to use the IR maize technology,' notes Dr Omanya.

'The key challenge for the project has been the production of sufficient quantities of certified IR maize seed, which has slowed down the adoption of the technology by farmers,' says Dr Omanya. 'We are encouraged however by the increase in seed quantities each year but this is still less than what the farmers require. In response, therefore, the project partners are working closely with seed producers to increase the production of the seed. We are hopeful that these enhanced efforts will encourage more seed companies to take up the technology and bring about positive results,' says Dr Omanya.

LEFT: Mr Isaka Mashauri, the Chief Executive Officer of Tanseed International Ltd, Tanzania, inspecting IR foundation seed maize on a farm near Iringa, Tanzania.

Dr Gospel Omanya

AATF Seed Systems Manager

In Africa, the delivery and adoption of new agricultural technologies by smallholder farmers has been elusive. Numerous reasons have been cited for this trend, including lack of awareness and difficulties in appropriately tailoring the technologies towards smallholder farming systems. In addition, many smallholder farmers lack adequate resources to acquire the technologies. Climatic challenges, such as highly erratic onset and uneven distribution of rainfall, further complicate the issue.

We have experienced most of these obstacles firsthand in the *Striga* project. However, we have not let them deter us in our dissemination of the innovative IR maize technology. To the contrary, our experiences have provided invaluable insights that will inform product deployment of all AATF projects. One of the key lessons that we have learnt is that alongside promoting products and reaching out to farmers, it is equally important to address the commercialisation aspects (seed production and distribution) simultaneously. This will ensure that knowledge and awareness of the product by farmers is in synchrony with actual availability of the products through the agro-dealer networks located in the target areas. We have also observed that stewardship guidelines encompassing the way that the product is handled and used are critical in ensuring that capacity building of extension service providers, agro-dealers, and farmers is done appropriately.

As the manager responsible for this project at AATF, I have utilised the ability to foster strong partnership and stakeholder networks. This includes defining the roles of partners, effective monitoring and evaluation and addressing challenges in a timely manner, as they occur in the project. These goals not only require adequate resources, but a clear mind, a strong heart and dedication. The project offered critical lessons in patience and endurance, which contributed to production of 30 tonnes of IR maize seed in Kenya and Tanzania in 2010 alone. Further, 3 tonnes of foundation seed was produced in Tanzania for use in production of about 100 tonnes of seed in 2011. The promotion activities elicited and maintained the interest of five seed companies, who are now actively involved in certified IR maize seed production. And, more importantly, we can humbly speak of having reached at least 50,000 farmers through IR maize field workshops and actual seed sales. The IR maize journey is therefore on the right path to achieving the targeted goal!

Dr Gospel Omanya inspecting IR foundation seed maize on a farm near Iringa, Tanzania.

Second CFT Planted Successfully in Nigeria

In 2010, the AATF *Bt* Cowpea Project team made major progress in all aspects of its work. One of the key achievements was the planting of the second confined field trial (CFT) of the *Bt*-expressing cowpea at the Institute of Agricultural Research (IAR), in Zaria, Nigeria.

The CFT reflected the advancement made by our collaborators at the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia, led by Dr TJ Higgins, in developing transgenic cowpea events. 'Out of 255 lines that they have developed so far, we carefully selected three promising transgenic events through laboratory and greenhouse analysis. Amongst other attributes, these three events had better phenotypes than the ones we used in the first CFT, which we conducted in 2009,' says Dr Nompumelelo Obokoh, the Project Manager.

The CFT, Dr Obokoh further notes, shows the effective partnership between the cowpea team and the Nigerian regulatory authorities – the National Agricultural Quarantine Service (NAQS) – and from the Federal Ministry of Environment. This relationship ensured that all plans regarding the importation, the delivery of the seeds, and the preparation of the CFT sites proceeded efficiently and in compliance with all security and safety requirements.

TOP: Ishaku Musa, one of the project technicians at IAR, infesting the *Bt* cowpea with Maruca.

LEFT: Mrs Aderanti of the International Institute of Tropical Agriculture (IITA) infesting *Bt* cowpea with *Maruca* at the trial site at the Institute of Agricultural Research (IAR), Zaria.

RIGHT: *Maruca*-resistant cowpea project entomologist, Dr Stephen Misari, inspecting the *Maruca*-resitant cowpea CFT at the trial site at the Institute of Agricultural Research (IAR), Zaria.

TANZANIA. Traditionally, women from the Datoga tribe wear beautifully tanned leather dresses, coiled brass ornaments and bracelets, and some women wear bracelets made from iron. Colours most often used in beadwork are yellow and light blue.

'We received the 300 seeds for the CFT from Australia in time for the planting season. By then, we had obtained a report expressing satisfaction on the Initial Environment Examination (IEE) in respect of the previous CFT from the United States Agency for International Development (USAID), and proceeded to prepare the site for the second trial,' says Dr Mohammad Ishiyaku, the project's Principal Investigator at IAR.

The second CTF was laid out as a randomised complete block design. In addition to the three transgenic events, the experiment also included a wild cowpea type and a commercial check. Parallel to this, the breeding team screened the F1 hybrids derived from crosses between the parents, which are a cowpea race known as Kanannado, and the transgenic lines evaluated in the first CFT. This exercise is important in the project's genetic studies being conducted by a postgraduate student, Muhammad Saba, on the inheritance of the transgene and its association with growth and morphology in different cowpea, and for the eventual selection of the *Bt* carrying recombinant that has desirable traits.

Aside from application of the recommended dose of nitrogen fertiliser, no insecticide applications were made on the crop under CFT. However, the partners took measures to prevent thrip infestation and ensured there was no unintended release of the material outside the confinement by providing 24-hour security.

'One of the greatest challenges we have had so far in the trials at IAR is in getting significant *Maruca* infestations in the field. This infestation is essential because we need to challenge the events under trial with optimum pressure from the insects,' Dr Ishiyaku explains.

To resolve this issue, in 2010, AATF partnered with IITA to train the entomologists and technicians from the project on how to rear *Maruca* in the laboratory and then artificially infest the insect's second instar larvae into the CFT site. Those trained were from IAR, Institute de l'Environnement et de Recherches Agricoles (INERA), Burkina Faso and Savannah Agricultural Research Institute (SARI), Ghana.

Dr Stephen Misari, the project entomologist at IAR who also optimised the infestation procedures to suit the field conditions in Africa, adds that after the training, the IAR team successfully made four artificial infestations of *Maruca*.

'We were delighted to note that while the larvae fed on the non-transgenic cowpea, they did not attack the transgenic varieties,' says Dr Misari.

Dr Ishiyaku further noted that the team's agronomic analysis revealed two transgenic events as the best, especially in terms of pod and grain yield after infestation.

According to the project's advisory committee, the level of the *Bt* protein in tissues targeted by *Maruca* needs to be quantified.

There is also need to extend the length and the intensity of infestation for maximum pressure in subsequent trials.

Working with the community

The team recognises that its achievements are dependent on an enabling environment, as well as the involvement of various stakeholders. During the year, the project made progress towards enhancing stakeholder awareness and participation in the project. A sensitisation workshop on biotechnology was conducted at the Ahmadu Bello University, in Zaria, attended by representatives from IAR University, traditional and community leaders, agro-input dealers, the media and tertiary institutions. This forum opened the communication lines for interactions between the project and the community especially on general biotechnology issues and the expected benefits of the *Maruca*-resistant cowpea.

Parallel to the ongoing work of identifying the suitable lead event, the team has also started in advance designing the roadmap and identifying key stakeholders who will play a crucial role in the successful dissemination of the deregulated product. 'This approach is critical in ensuring that different groups, for instance decision and policy makers, seed producers, agro-dealers, extension services, community based organisations (CBOs) and farmers, are sensitised in a timely manner,' says Dr Obokoh.

Sharing information and experience

The *Bt* cowpea team participated at the fifth World Cowpea Conference in Dakar, Senegal, where it shared its experiences with participants and through the print and electronic media. In addition, the team presented the project at the annual conference of the World Federation of Science (WFS), held in Abuja, Nigeria.

The team is also facilitating the strengthening of capacity in the partner countries, especially around communication of biotechnology issues and regulatory management. During the year, several training sessions were conducted for journalists, communications and information officers from selected agricultural research institutes, and even project staff. These forums were also used to introduce the *Bt* Cowpea Project to wider audiences.

Dr Obokoh notes that the progress being made in Nigeria will lay the ground for tests on the transgenic events in other countries. Therefore, it is important to develop standardised protocols for field infestation and agronomic trait assessment. This information will be used for field trials in other geographic locations once the respective approvals are obtained. Towards this objective, in July 2010, a workshop on compliance issues regarding CFTs was organised for the staff from SARI who are involved in the *Bt* Cowpea Project.

In Burkina Faso, a CFT application was approved by the Agence National de Biosécurité towards the end of 2010, paving the way for the country to become the second in Africa to test the *Bt*-expressing cowpea.

LEFT: *Maruca* attacking the cowpea plant.

RIGHT: Infestation of the cowpea plant with *Maruca* using plastic tubes.

Dr Nompumelelo H Obokoh

Bt Cowpea Project Manager

Dr Nompumelelo Obokoh inspecting the *Bt* cowpea CFT at Zaria, Nigeria.

I joined AATF in 2008 as the manager of the *Bt* Cowpea Project. This assignment is fulfilling and challenging as it involves the coordination, implementation and monitoring of the entire product value chain to ensure the successful development and deployment of regulated *Bt* cowpea. I also head the operations of AATF in west Africa.

In May 2009, I relocated to the AATF office in Nigeria, a timely and exciting move, which coincided with the approval and the establishment of the first ever confined field trial (CFT) of the *Bt* cowpea in Africa. I have enjoyed working closely with project partners in Nigeria, Burkina Faso and Ghana, and their support and commitment has been tremendous. We have made great progress based on mutual respect and dedication to succeed against all odds. We have also forged international partnerships, for instance with the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia – where the plant transformation and generation of transgenic events is being carried out. The project has also benefitted from collaboration with Purdue University and Donald Danforth Plant Science Centre, USA.

I have found the skills I gained from my previous national and international assignments in agricultural research and development extremely useful in my current role. I trained as a plant molecular biologist at the University of Cambridge, UK. I used novel and high throughput technologies to study and improve the growth of plants and their yield against various biotic and abiotic stressors. In the process, I acquired a combination of skills and knowledge in plant tissue culture, gene transformation, green house studies and molecular analysis using different techniques. In addition, through a project funded under the EU-Framework Programme 5, I learnt how to work in partnerships. The project involved University of London, Royal Holloway in the UK, the Institut National de la Recherche Agronomique (INRA) in France; Max-Planck Institute in Germany, CropDesign in Belgium, and VBC-Genomics in Austria.

I was able to translate these skills into practical action when I joined the Biotechnology Division at the Agricultural Research Council in Pretoria, South Africa, as a Programme Manager. The goal of the programme was to help farmers and rural communities to access improved crop varieties which have high nutritional value. I managed several projects geared towards the genetic improvement of neglected African crops, such as cowpea and traditional herbs, collectively known as *Amaranthus*. I also supported a team of South African and American researchers that was aiming to develop *Bt* potato during the confined field trials phase of the project in South Africa.

Through a fellowship at the then Institute of Grassland and Environmental Research (IGER) in Wales, sponsored through the Rothamstead International, UK, I enhanced my research skills by identifying and developing molecular markers for drought tolerance in cowpea.

During that period, I received competitive grants from the National Research Foundation (NRF) and from the NRF/Royal Society (UK) for the South Africa-UK Science Networks to establish linkages and extend the collaboration with UK project partners. I also received extensive training in project management from the University of Cape Town, South Africa.

Heading the *Bt* Cowpea Project is not without challenges, but the partners have gladly offered their support, and enthusiastically contributed to possible solutions. The journey may seem long, but I believe that we will soon realise the dream of providing smallholder farmers in Sub-Saharan Africa with the best *Maruca*-resistant varieties of cowpea. I believe we have a good foundation, based on the national and international partnership that we have formed.

Confined Field Trial Planted in Uganda

On 5 October 2010, AATF, the International Institute of Tropical Agriculture (IITA) and the National Agricultural Research Organisation (NARO), Uganda, planted banana transgenic lines developed through the Banana BXW project in a confined field trial (CFT) at the National Research Institute in Kawanda, Uganda. The CFT, which attracted high-level media publicity including being featured in the journal *Nature*, was significant in several ways.

First, it marked advancement in the project's basic scientific goals, which include the transformation, molecular characterisation and evaluation of transgenic banana. A total of 65 transgenic lines were planted in the CFT, based on their promising results for BXW resistance under laboratory and screen house conditions. The lines, which are of three banana cultivars – Sukali Ndiizi, Nakinyika and Mpologoma – contain either the plant ferredoxin like protein (*pflp)* gene or the hypersensitivity response assisting protein (*hrap)* gene, which is isolated from sweet pepper. The incorporation of *hrap* and *pflp* is based on the pioneering work of Prof Teng-Yung Feng of Academia Sinica in Taiwan, which has shown the gene to improve the disease resistance of vegetables including broccoli, tomatoes and potatoes.

'Our work is groundbreaking in two ways: it is the first time that the *hrap* and *pflp* genes have been used in bananas in Africa, as well as the first time that the technology is being tested in the field,' says Dr Leena Tripathi, an IITA biotechnologist, who is the project's lead investigator.

LEFT: Prof Teng-Yung Feng of Academia Sinica in Taiwan discussing transgenic bananas with Nancy Muchiri of AATF at a confined field trial (CFT) site at Kawanda, Uganda.

UGANDA. This Karamajong woman is wearing a traditional shawl (*kukoi*), beaded necklace and earrings. The plastic for the earrings is obtained from the rear lights of motor vehicles. Such earrings are readily available for purchasing in the local market.

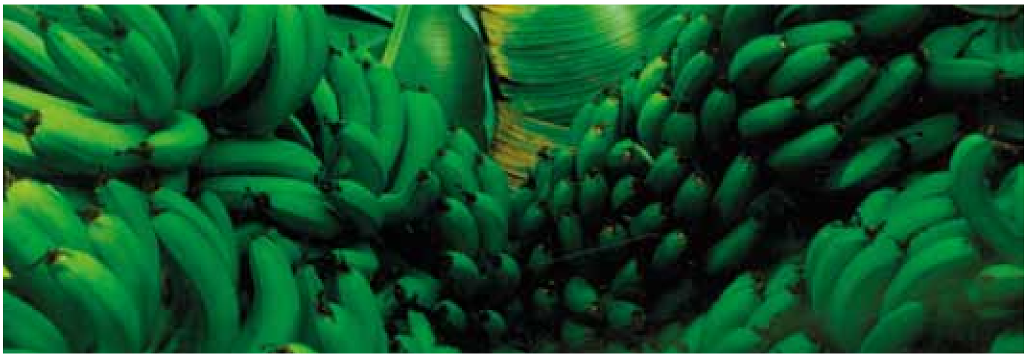
Moreover, preliminary results of the BXW project indicated that the *hrap* and *pflp* genes also have the potential to provide resistance to the banana fungal disease known as black Sigatoka. Therefore, further tests on this disease will also be conducted during the trial. In addition, the CFT will analyse whether there are any effects on the composition of microorganisms in the soil. These plants will be grown side by side with another genetically modified (GM) banana variety developed at the laboratory, which has been fortified with vitamin A and iron to help combat blindness and anaemia in rural areas.

Sharing experience and information

The scientific achievements made through the project were presented at several international forums, for instance the 12th International Conference on Plant Pathogenic Bacteria (ICPPB) 2010, held in La Reunion in June 2010. The achievements were also published in peer-reviewed journals including the *Molecular Plant Pathology*.

Further, the CFT marked a major step for the project partners towards addressing some of the legal roadblocks regarding deployment of GM crops in Uganda. As of 2010, Uganda's biosafety law only existed in draft, based on a biotechnology and biosafety policy adopted in 2008. However, AATF, IITA and NARO worked in partnership with the Ugandan Institutional Biosafety Committee (IBC) to ensure compliance to the regulatory requirements, and approval by the Uganda National Biosafety Committee (NBC). In accordance, the AATF project partners plan to keep the NBC updated on the CFT through regular progress reports.

The project partners plan to deploy the BXW resistant banana in five countries in the Great Lakes region: Kenya, Uganda, Tanzania, Rwanda and Burundi. However,



they are mindful of the fact that each of these countries has its own specific review and approval processes for transgenic crops. Importantly, in Burundi, Rwanda and Tanzania, there have not been any trials on transgenic crops as yet. During the year, therefore, AATF drafted a regulatory approvals strategy for the project to support this plan. 'The strategy, titled "Banana Project Strategy on Regulatory Approvals", takes into account the regulatory environment in the five countries as well as the capacities essential for conducting a sound confined field trial. The document is currently under review for publication during 2011,' says Dr Francis Nang'ayo, the AATF Regulatory Affairs Manager.

The other task for the project partners, says Dr Tripathi, is to ensure that the practitioners are well prepared and skilled for the mass micro-propagation of banana plantlets in the target countries. Towards this goal, in 2010, the partners held a regional training at the Kenya Agricultural Research Institute in Thika, Kenya. The forum brought together public and private sector practitioners in banana tissue culture from the Great Lakes region of Africa.

'The participants were greatly impressed by the improved laboratory procedures for development and refinement of banana tissue culture technology, and their potential to cut costs, ensure quality, as well as efficient production and deployment of tissue culture plantlets. The workshop also provided an opportunity for networking and creating public-private partnerships towards the improvement of the production and dissemination pathway,' Leena notes.

Overall, the transgenic banana CFT in Uganda marks a major step in the goal of AATF, IITA and national research partners to alleviate the threats posed to food security and income by the BXW disease.

LEFT: Transgenic bananas at a confined field trial (CFT) site at Kawanda, Uganda.

Dr Leena Tripathi

Principal Investigator, BBX Control Project

Dr Leena Tripathi inspects transgenic bananas at the Kawanda Agricultural Research Institute, Uganda.

For the last 15 or so years, I have spent most of my time in the laboratory, speaking the language of genetic engineering, molecular biology and diagnostics. I attained my doctorate in plant molecular biology from the National Botanical Research Institute, Lucknow, India and a post doctorate from the University of North Carolina at Greesboro, USA. In 2000, I joined IITA as a plant biotechnologist and the principal investigator in the project that seeks to develop biotechnological tools to control the *Xanthomonas* wilt in bananas. My skills and excellence in these techniques have earned me recognition as one of IITA's top scientists.

However, the most memorable event of my career occurred not in the laboratory, but in a field in Uganda, on 5 October 2010. This was the day when we planted the confined field trials (CFT) for bananas which are genetically modified to resist the wilt causing bacterium, BXW. The planting of the CFT gave reality to the efforts that my team and I have put in our quest to halt BXW. The occasion was also a source of pride because we planted the CFT right on schedule; exactly as per our planning six years earlier.

Our journey began in 2004, three years after the wilt disease was first noticed in two districts in Uganda. In that time, the disease had spread to the entire banana growing areas in the country. It had also gradually spread to the other east and central Africa countries. The effect of the wilt disease was especially devastating for small scale farmers, who depend on bananas for their daily food and for income. Most households in the affected countries obtain between 30% and 60% of their daily per capita caloric intake from bananas.

The ravage caused by the wilt disease was summed up by one farmer, an old man, who told me: 'This disease has not only wiped out my entire banana crop, it has also wiped out all my hopes for providing for my family.' This feeling of utter helplessness is shared by farmers in many countries, where agricultural constraints and lack of resources to address them makes food scarcity and poverty the norm.

I feel fortunate that my skills as a plant biotechnologist enable me to come up with innovative ways to respond to some of the cries from farmers, especially through the projects that I am leading on the genetic improvement of banana and plantain for disease and pest resistance.

The collaboration between IITA and AATF is key towards this objective. This is because the gene identified to confer resistance to BXW had intellectual property implications. AATF facilitated its acquisition and royalty-free licensing from Taiwan's Academia Sinica who hold the patent for it.

I also dedicate a lot of my time to building capacity especially in my areas of specialisation which include plant transformation, tissue culture and molecular diagnostics in addition to research. I am pleased to have trained more than 20 students and 60 NARS staff in the past 10 years. I am a member of the national coordination committee for BXW control in Uganda. I am also leading the DFID/BBSRC project on nematode-resistant plantains in collaboration with the University of Leeds, UK.

Confined Field Trials Approved in Kenya, Uganda and South Africa

In 2010, the Water Efficient Maize for Africa (WEMA) project performed well by achieving its milestones, the major one being receipt of approval for confined field trials (CFTs) of transgenic drought-tolerant hybrid maize from the regulatory authorities in Kenya, Uganda and South Africa, marking great progress towards getting the product to farmers in Sub-Saharan Africa.

This progress was the result of WEMA's effective partnership, which brings together Monsanto's molecular, genomics and biotechnology platforms, the International Maize and Wheat Improvement Centre's (CIMMYT) breeding programme and adapted maize varieties, AATF's expertise in product stewardship, regulatory affairs management and technology delivery, and the national institutions' capacity for breeding, testing, multiplying and distributing new maize varieties. In 2010, the partners had earmarked 12 hybrid drought-tolerant varieties developed through the project for the CFTs.

'Our application for permits to conduct the CFTs in Kenya, Uganda and Tanzania progressed much slower and in a more complex way than we would have wished. However, we worked closely with the regulatory authorities in the different countries and

LEFT: WEMA team members counting the seeds before planting the CFT site at Kiboko, Kenya.

KENYA. For the Masai, clothing denotes age, sex and place of origin as well as status. The cloths they wear (*shúkà*) are used to cover the body; one cloth is draped over each shoulder, and a third cloth covers these. The red colouring represents power. Warriors – or *morani* – are the only members of the community to wear long hair.

were vigilant to their requirements,' explains Dr Sylvester Oikeh, the Project Manager.

He adds that the process was also aided by mock trials conducted by the WEMA partners in Kenya and Tanzania, and by the first CFT conducted in South Africa in 2009. 'We harvested the crop in the two mock trials in the first quarter of 2010, under the supervision of biosafety inspectors, based on the standard operating procedures (SOPs) for CFTs in the respective countries. The officers then monitored the harvested crop every two weeks. They were satisfied that we had complied with all post-harvest requirements,' he says.

As a result, the WEMA partners received a Grant of Research Permit from the Office of the President, Uganda, to conduct a CFT at the National Research Institute in Kasese. In Kenya, the partners were issued with a Grant of Plant Import Permits (PIPs) to allow importation of seed for WEMA CFTs. The Directorate of Biosafety in South Africa renewed the permit for the WEMA partners to conduct a second round of CFT on transgenic drought tolerant maize. In Mozambique, the project partners conducted a mock trial.

Under the WEMA conventional breeding programme, a nursery was planted to form 50 three-way hybrids (a conventional version of the transgenic hybrids) that were identified from regional yield trials. The hybrids will be evaluated for adaptation and performance across environments in the five WEMA participating countries in 2011.

In addition, the WEMA team made progress in building the capacity of the product development teams, at national and international level, to conduct risk assessments and prepare safety data dossiers for submission to regulatory authorities for CFTs. This effort included the preparation of several documents, including a CFT Trial Site Manager's Handbook, a Compliance Training Manual, and the conduct of training workshops in Kenya, Uganda, South Africa and Mozambique.

In support of the approval of the CFTs, the WEMA Project partners in the various countries increased their cooperation with various stakeholders. For instance, in April 2010, the team held a regional stakeholders meeting and study tour in South Africa. The event involved over 70 participants, including leaders of farmers' and seed associations, members of parliament, permanent secretaries in the ministries of agriculture and science and technology, biotechnology service providers and media representatives.

'The highlight of the event was a visit to a *Bt* maize farm in South Africa. This was an important opportunity for the group to discuss issues related to GM maize first-hand with a farmer involved in their cultivation,' notes Dr Oikeh.

The WEMA partners engaged with stakeholders through various platforms such as agricultural and scientific meetings, where they shared information on the progress and aims of the project. These avenues were useful in promoting the scientific accomplishments made so far through the project, as well as in raising the overall profile of the initiative.

'Once the hybrid maize varieties are developed and tested, our aim is to work in partnership with a broad range of stakeholders to deliver the improved maize seed to farmers royalty-free, alongside the best agronomic practices. We were therefore encouraged to have made significant in-roads in 2010 in getting support of various key groups at this early stage,' says Dr Oikeh.

He notes, for instance, that the project partners were able to convene discussion sessions with relevant parliamentary committees, such as agriculture and science and technology, in Kenya, Uganda and Mozambique. The team also initiated reciprocal relationships with scientific colleagues, including biotechnology specialists, especially those working on climate change.

'In 2010, we greatly improved our partnership with the media. We remedied some significant challenges, such as lack of adequate information on the WEMA Project, and access to credible sources. These efforts bore fruit, as we had about 50 mentions in local and international media,' notes Dr Oikeh.

Dr Oikeh says a significant achievement of the project is its external audit process. As such, the project's key indicator of progress was the favourable 2010 external audit report of the Ethical, Social, Cultural and Commercialisation (ESCC) Program. 'Since public-private partnerships like WEMA, and the development of genetically-modified crops, have unique issues of public trust, the aim of the audit is to build trust in the project, create an accountability system and ensure transparency among stakeholders,'. The social audit awarded the project an encouraging overall rating of 'good'. 'The report also showed a significant improvement in particular aspects of the audit, especially good knowledge of the project, interactions among partners and communication with stakeholders,' Dr Oikeh explains.

'One of our major challenges at the moment is the low understanding or knowledge of biotechnology especially genetic modification in Africa. For this reason, we are working with farmers and seed companies during the development phase of the project to ensure that we are conveying the right information as well as realistic expectations regarding the transgenic drought-tolerant maize,' concludes Dr Oikeh.

TOP: Dr Santie deVilliers (right) of ILRI (BecA), Nairobi, Kenya, addresses east African journalists during a lab visit for participants attending a workshop on science reporting organised by WEMA in January 2010.

BOTTOM: Mr Molatsi Musi (right), a *Bt* maize farmer, explains a point to the participants to the WEMA regional stakeholders meeting held in April 2010 in South Africa during a field trip to his farm in Olifantsvlei near Johannesburg, South Africa.

Dr Sylvester Oikeh

WEMA Project Manager

I will always remember the year 2010 with pride. It was during this year that we received the outcome of the Mid-term External Review, which confirmed that the WEMA Project was on the right path.

The review, which was commissioned by the Bill and Melinda Gates Foundation, stated that: 'WEMA is in good health and is staffed by enthusiastic and dedicated staff who believe passionately in the value of the project's goals and field activities.'

For me, joining AATF in February 2009 and becoming the project manager of the WEMA Project fulfilled my yearning to make a significant difference in the lives of smallholder farmers in Africa. I brought to the project wide experience in agricultural research and development, most of it gained in multi-disciplinary projects. They include projects for mitigating the effects of a changing global environment and man-made disasters on rice-based livelihoods and food security in Sub-Saharan Africa, agronomy, soil fertility management and plant nutrition.

I previously worked at the Africa Rice Centre, Benin Republic, as a Soil Fertility-Agronomist for five years. In this role, I worked closely with farmers to develop agronomic technologies for enhancing productivity while sustaining the production base. I led the development of four integrated soil fertility management packages for enhancing the productivity of NERICA rice while sustainably managing the fertility of the soil.

As part of my post-doctorate research at Cornell University, USA (2001–2002), I was the first to establish the linkage between enhanced iron and zinc in maize grain with improvement in human nutrition using an *in vitro* technique (model gut-system) to reduce human micronutrient deficiency diseases, particularly iron deficiency anaemia in west Africa.

Working as a GTZ Research Fellow (1993–1996), I contributed to enhancing the knowledge on the mechanisms involved in nitrogen-use efficiency in maize and sorghum, which led to development of the model maize for low-nitrogen environments in west Africa.

In the WEMA Project, I manage and motivate teams of diverse professionals to develop drought-tolerant maize for smallholder farmers, one of the biggest public-private biotechnology partnership projects in Sub-Saharan Africa.

Dr Sylvester Oikeh inspecting drought tolerant maize at KARI, Kakamega, Kenya.

I also coordinate the development of the second phase of the project, which is targeting product deployment to the farmers through an innovative model of product commercialisation/seed system.

Some of these tasks require greater efforts than others. The most significant challenge I regularly face is that of ensuring that the project partners, who are in different countries around the world, meet their deadlines and deliver on promised milestones.

I believe that appropriate agricultural biotechnology provides useful tools to enhance food security in Africa. For example, agricultural biotechnology can be used to develop genetically enhanced crops that are tolerant to drought such as the WEMA products, those that are resistant to pests and diseases or those with increased nutritional value. However, these benefits will only be fully realised if the necessary biosafety frameworks are put in place.

Project Prepares for Confined Field Trials for Transgenic Rice in 2012

In 2010, the development of the transgenic nitrogen-use-efficient (NUE) rice lines progressed well and on schedule at Arcadia Biosciences heightening possibility of carrying out confined field trials (CFTs) in 2012. The goal is to deliver T2 NUE lines that are homozygous, selectable marker-free, have good levels of NUE expression and have no vector backbone sequences by the end of 2011.

In December 2009, AATF and Arcadia Biosciences agreed to incorporate the water use efficient (WUE) component into the project. As a result, in 2010, Arcadia Biosciences started construction and co-transformation of the WUE binary vectors. However, during the sequencing process, it was discovered that the two binary vectors (for the selectable-marker and for the salt tolerance gene) donated by PIPRA had extra sequences. The selectable marker-vector was repaired, while the reconstruction of the salt tolerance gene advanced commendably. The team at Arcadia Biosciences and PIPRA has committed itself to fast-track the process, enabling the project partners to start plans to conduct CFTs in 2012.

The project partners also agreed that instead of continuing with the originally planned WUE-ST co-transformation pipeline, Arcadia Biosciences would start a transformation pipeline with a cheaper triple gene stack vector, incorporating all the three traits in one vector (NUE-WUE-ST) in upland Nerica only. The goal is to deliver 20-30 NUE-WUE-ST (NEWEST) T2 rice lines by September 2012 for testing in Africa.

LEFT: A farmer harvesting rice in Deve, Benin.

NIGERIA. The *aso oke* worn by this Yoruba man is made from material specifically woven for the purpose; cotton, velvet and damask is also used. These hats originated in Nigeria, but are now worn by men from various African countries.

Land preparation for CFT

Land preparation for both the upland and lowland transgenic rice in Ghana commenced with the identification of suitable sites and hotspots for salt tolerance trials. The land for NUE trials was acquired in Bomfa, in the Ejisu-Juaben District of the Ashanti Region, based on several requirements, including the non-dependence on precipitation, the availability of a perennial water source in addition to wells, the levelness and uniform fertility of the land as well as its accessibility.

'We also considered the rice culture as well as isolation in regard to regulatory requirement,' explains Dr Paul Koffi Dartey, rice breeder and Principal Investigator at the Crop Research Institute (CRI), in Kumasi.

He further explains that in order to test the performance of the NUE transgenic events in the field, it was necessary to conduct such experiments on soil that was severely depleted of nitrogen/nitrogen deficient. The team therefore started by planting several crops of maize which is known to utilise nitrogen at a high rate.

A few challenges were encountered in the process. For instance, depressions had occurred in the lowland NUE fields during the levelling process. These sites collected standing water in the rainy season, which affected the growth of the maize. Birds caused further damage to the crop. The team remedied the situation by further levelling off the ground and planting a second crop of maize in November 2010.

Similar activities were conducted at the National Agricultural Research Organisation (NARO) in Uganda. The work, which was co-ordinated by Dr Jimmy Lamo, rice breeder and Principal Investigator in Uganda, included civil works to lay the water pipes and installation of a water tank and concrete fence posts. The field development started with slashing, felling trees, clearing anthills and digging the field in preparation for maize planting.

As part of the preparatory process for the CFTs, the principal investigators from Ghana, Uganda and Nigeria visited the NUE rice trial site at the International Center for Tropical Agriculture (CIAT), Colombia, led by Dr Joe Tohme and his team, to familiarise themselves with the procedures and the phenotyping platform used, with the aim of standardising the protocols in Africa.

Regulatory approvals and agreements

The preparatory process for the transgenic rice CFTs also includes obtaining the necessary approval from the Institutional Biosafety Committees (IBC) and the National Biosafety Committees (NBC) of the respective countries. The project started this process in Ghana and Uganda. Officers from the Ghana NBC visited the site selected for the rice CFT and expressed satisfaction with the site, encouraging the commencement of the application process. Compliance training workshops addressing pertinent biosafety compliance requirements during transportation, planting and harvesting of transgenic rice were conducted by AATF in both countries for the project teams.

'We considered this session a training-of-trainers workshop that is expected to translate into further training of all staff associated with the project,' says Dr Francis Nang'ayo, the AATF Regulatory Affairs Manager.

An important activity for the team is to show that the project is technically and economically feasible. For this reason, in May 2010, a feasibility study on the NEWEST Rice Project was conducted, and later revised to incorporate the water use efficiency (WUE) component. The study results confirmed the projected 30% increase in rice

LEFT: Nerica rice farmers in Deve, Benin.

yields and a 21% expansion in the land under irrigation on the NEWEST rice.

'The results of the study further confirm that this project is technically and economically feasible and that it will lead to a breakthrough in the introduction of transgenic rice varieties in SSA,' says Mr George Marechera, the AATF Business Development Manager.

The future development and commercialisation of the rice varieties with enhanced nitrogen use efficiency and salt tolerance will require further license/sublicence agreements and material transfer agreements. Therefore, AATF is in the process of negotiating and drafting the necessary set of agreements to support the use of the plant transformation platform for this project. AATF is finalising negotiations with Arcadia Biosciences on the transfer of the water use efficiency patents/patent applications, and finalising the humanitarian use licence/bailment agreement between AATF and UC Davis. A substantial part of the humanitarian license terms have been developed with staff from the Public Intellectual Property Resource for Agriculture (PIPRA) and the University of California Davis (UC Davis), as well as pro bono services from Morrison and Foerster. AATF has therefore provided supplementary funding to PIPRA to help finalise the NUE-ST rice humanitarian license between UC Davis and Cornell University.

Efficacy of AflaSafe™ Confirmed

In 2010, the Aflatoxin Control Project team confirmed that AflaSafe™, the first indigenous aflatoxin biocontrol technology in Africa, is capable of significantly reducing the risk posed by this highly toxic, carcinogenic poison, even in cases where crop products have been stored poorly.

This conclusion was based on post-harvest studies conducted by the International Institute of Tropical Agriculture (IITA) and its partners on maize and groundnut produce from farmers' fields in Kaduna State, Northern Nigeria, which had been treated with AflaSafe™ in 2009.

Almost three quarters of the maize harvested from the treated fields complied with the aflatoxin safety standard set by the United States, and was therefore safe for human consumption. In contrast, two-thirds of the maize that was harvested from fields that had not been treated with AflaSafe™ had aflatoxin levels that made it unsafe to eat. In addition, the team found that even after being stored under poor conditions, maize harvested from the fields that had been treated with AflaSafe™ showed reduced aflatoxin levels. This means that the biocontrol strains are carried from the field to the store, where they continue to protect the produce against atoxigenic strains of *Aspergillus*.

TOP: Dr Ranajit Bandyopadhyay discussing with maize farmers.

LEFT: Farmers spreading AflaSafe™ in maize farms.

GHANA. This dancer dons traditional attire of feathers and shells for the annual Nafac Festival in Ghana.

Studies carried out in 2010 have also shown AflaSafe™ to be effective in significantly reducing aflatoxin in groundnuts, offering farmers better market opportunities. Fields treated with AflaSafe™ recorded an overall aflatoxin reduction of 97%. Aflatoxin concentration ranged from 0 to 825ng/g in the control fields with a mean of 58.3ng/g compared to the treated fields where aflatoxin concentration ranged from 0 to 13ng/g with a mean of 2.9ng/g.

'These results confirm that AflaSafe™ can significantly lower the risk of aflatoxin for the maize and groundnut consumers, and it can also help to improve the marketability of the produce,' explains Dr Ranajit Bandyopadhyay of IITA, who is the project's principal investigator.

Encouraged by the results, the project prepared a draft dossier containing the efficacy data of AflaSafe™, which was submitted to Nigeria's apex regulatory authority, the National Agency for Food and Drugs Administration and Control NAFDAC for comments. The dossier is being revised to pave the way for full registration of AflaSafe™.

Moreover, in 2010, the project produced another 1.2 tonnes of AflaSafe™, which was deployed in 20 smallholder farmers' fields in Kaduna State, Northern Nigeria. In addition, AflaSafe™ was extended to 14 commercial maize growers in the state. This latter group of farmers was trained on the inoculation techniques and was able to personally inoculate their farms with AflaSafe™. Sixteen groundnut fields in Kaduna State were also treated with AflaSafe™.

'At the moment, we are trying to determine how often – annually or every other year – we need to treat the farmers' fields with AflaSafe™. In addition to determining the application requirements, it is also important to understand the timing of application of AflaSafe™. In order to achieve optimum reduction levels, 10 kilogrammes of AflaSafe™ should be applied per hectare two to three weeks before the crop flowers,' says Dr Bandyopadhyay.

Biological control of aflatoxin in Kenya

The project also started efforts to control the risk of aflatoxin in Kenya, where, in the past seven years, significant outbreaks have caused major fatalities in four districts. Dr Bandyopadhyay notes that aflatoxin strains *Aspergillus flavus* found in the affected areas of Kenya are some of the most potent producers of aflatoxin ever found and unique to Africa.

During the past five years, competitive atoxigenic strains of Kenyan origin were identified at the United States Department of Agriculture, Agricultural Research Service (USDA-ARS), in a laboratory headed by Dr

Peter Cotty. In 2010, AATF, in partnership with IITA, USDA-ARS, the Kenya Agricultural Research Institute (KARI) and the Kenya Plant Health Inspectorate Services (KEPHIS), initiated efforts to evaluate the efficacy of these strains in on-station trials in Kenya.

'We made a formal request to the Kenya Standing Technical Committee on Imports and Exports (KSTCIE) to repatriate fungal strains into Kenya to conduct on-station trials during the October–January cropping season,' says Dr Francis Nang'ayo, the AATF Regulatory Affairs Manager.

Sharing experience and information

Dr Bandyopadhyay explains that it is vital that members of the public are aware of the effects of aflatoxin contamination, the management practices, including biocontrol, which can reduce aflatoxin contamination in maize and groundnut.

In accordance, in 2010, the project publicised AflaSafe™ through print, broadcast, as well as digital media in Nigeria, across the continent, and internationally.

In addition, the team held meetings with farmer groups to discuss further use of AflaSafe™ and other aflatoxin management strategies that will improve maize quality and provide better market opportunities for farmers. The project also promoted the knowledge being produced through it at major agricultural, scientific and business conferences in Nigeria.

Overall, the aflatoxin biocontrol project has significant implications for a range of stakeholders. At a United Nations Industrial Development Organization (UNIDO) conference organised for the private sector, the project discussed the business potential of the biological control of aflatoxins in Africa. UNIDO is assisting AATF and partners to find a commercial manufacturer and spread information about AflaSafe™ to the organised private sector in Nigeria.

The project also highlighted the potential of AflaSafe™ at a stakeholders' meeting organised by the Nigerian Export Promotion Council (NEPC), Federal Ministry of Commerce and Industry, in Nigeria. Nearly 75 participants including maize farmers, extension agents, health officials, donors, and representatives of development and regulatory agencies attended the meeting.

'Based on our efforts, the awareness of the effects of aflatoxin contamination is growing and we are establishing networks with organisations that are willing to partner with us on the control of aflatoxin contamination in Nigeria and Kenya,' explains Dr Bandyopadhyay.

So far, studies by the project show that when combined with good post-harvest practices, AflaSafe™ can significantly reduce the levels of aflatoxin contamination.

'We therefore recommend that more effort be made towards creating awareness and liaising with regulatory bodies to ensure that food and feed products that are being sold in the market are within the aflatoxin regulatory limit. It is important that awareness and training on aflatoxin control for farmer groups continues,' concludes Dr Bandyopadhyay.

LEFT: Dr Ranajit inspecting inoculum before delivery to farmers.

Dr Ranajit Bandyopadhyay

Principal Investigator, Aflatoxin Biological Control Project

Besides two sabbaticals, I have spent my entire working career in the Consultative Group on International Agricultural Research (CGIAR). Through the years, my main area of interest has been mycotoxins, principally aflatoxin, though my research has also touched on other diseases like sorghum grain moulds, ergot and anthracnose, soybean rust, and banana *Xanthomonas* wilt.

I have had several highlights in my career; but the most significant has to be when the first fistful of AflaSafe™ was tossed onto African soil, in Nigeria in 2009. Of course, I was equally excited to be part of the events leading to receiving permission from the Kenya Standing Technical Committee on Imports and Exports (KSTCIE) to repatriate Kenyan atoxigenic strains to Kenya, producing inoculum and rushing it, with the heart racing, to Nairobi so that fields could be treated in time.

I had become part of the effort to develop AflaSafe™ immediately after joining IITA. We applied for a grant to BMZ to extend the initial biocontrol work that was started by my predecessor, Dr Kitty Cardwell, in Benin. We got the grant in 2003 and proceeded with the research and development that gave us a product that is now almost ready for commercialisation.

The initial success in Nigeria motivated us to begin work in Senegal to identify atoxigenic strains, which was followed by further work in Burkina Faso. That expansion has continued since then to Mozambique, Zambia and Peru, and we are also optimistic about a decision on a grant we are awaiting for Mali, Ghana and Tanzania.

To me, science is of little value if it is not of benefit to poor people. Therefore, in my planning I am always looking at the bigger picture, aiming to integrate diverse hard and soft disciplines so that eventually we can bring research products into the hands of farmers. This is one of the strengths of IITA and I have also been fortunate to receive extraordinary support from IITA. I consider the wider developmental issues, the building of partnerships, training, communication, awareness and advocacy critical in my efforts to translate what I do in the lab into health and income benefits of smallholder farmers in Africa.

Dr Ranajit Bandyopadhyay showing aflasafe and discussing how it works to reduce aflatoxins with farmers in a maize field near Zaria, Nigeria.

An exciting but challenging aspect of my work has been the need to handle a wide range of activities from science at one end and advocacy and business development on the other. In this endeavour, I have obtained the support of several donors (more recently from the Bill and Melinda Gates Foundation) and individuals.

A good example of such partnership is our work with the inventor of the aflatoxin biocontrol technology, Dr Peter Cotty of USDA-ARS at the University of Arizona. Peter has graciously allowed us to use his patent on 'competitive exclusion' for humanitarian purposes in Africa. The strains we used in Kenya were identified in his lab, and he has given open access to them. Peter continues to work with us in fostering aflatoxin biocontrol efforts in Africa.

I also remember teaming up with Peter and Margaret McDaniel of USDA-FAS, going from one donor to the next in Washington DC, to seek support for the control of aflatoxin. Our efforts culminated in the formulation of the CAADP-Partnership Platform, endorsing Partnership for Aflatoxin Control in Africa.

I must acknowledge the support from AATF, which has been crucial not only with respect to funding the work in 2008 and 2009 which kept the research alive when other sources of funding had reduced, but also in supporting partnership management and advocacy.

The task ahead is challenging – what with the rapid expansion of aflatoxin biocontrol activities in Africa. However, the goal is inspiring. I look forward to the day when at least one million farmers in Sub-Saharan Africa will have access to aflatoxin biocontrol and management technologies, enabling them to improve their health – and that of their consumers, many of whom are children and women – and income.

Effective Regulation of Biotechnology in Sub-Saharan Africa

The year 2010 marked the fifteenth anniversary of the commercialisation of biotechnology crops. By then, the total global area under biotech crops was estimated to exceed over one billion hectares, covering large and small-scale farms.

WEMA partners inspecting transgenic maize at KARI, Kiboko, Kenya.

The rise in the adoption of modern biotechnology solutions like genetic modification (GM) technology has been spurred on by various agricultural constraints, for instance low crop yields arising from pests, diseases and drought.

However, the increasing interest in GM technology has been accompanied by concerns regarding the safety, ethical and commerce-related aspects of genetically modified organisms, and calls for strict regulation of GM products, fronted by consumer and the environmental watchdogs.

The varying ideological, political and market considerations in the development of GMO technology have influenced the nature and scope of the regulations strategies being adopted by countries or economic blocs.

In Africa, some of the factors that have influenced policy positions on GM technology include concerns regarding potential threats to the biodiversity, possible loss of markets, food safety and disease epidemics as well as apprehension about the capacity of specific countries to ably harness GM technology.

In accordance, many African countries have signed and ratified the two major instruments that seek to facilitate the exploitation of the potential benefits of modern biotechnology while safeguarding against potential risks, which include the guidelines and standards set by the International Plant Protection Convention (IPPC), the Codex Alimentarius Commission, and the Cartagena Protocol on Biosafety to the Convention on Biological Diversity.

SOUTH AFRICA. Traditionally, Xhosa women adhere strictly to dress codes. Married women cover their heads, and headdresses serve to denote the woman's status in the community.

These instruments oblige signatories to take appropriate legal, administrative and other measures to ensure that the development, handling, trans-boundary movement and utilisation of living modified organisms (LMOs) is undertaken in a manner that reduces the risks to biological diversity and human health.

There are two key biosafety regulatory processes. The first is the 'Risk Assessment', which seeks to determine both the probability of particular risks and the consequence if that risk does become a reality. The second, the 'Risk Management', seeks ways to manage that risk, to reduce the probability of occurrence or to reduce the magnitude of the consequence.

At country level, regulatory oversight on safety of GM technology is enforced through national biosafety frameworks (NBFs). NBFs therefore need to be as comprehensive as possible in ensuring that activities relating to GM technology proceed in a safe and highly responsible manner.

Generally, African countries fall under four categories in terms of the existence of operational NBFs, ranging from fully-functional frameworks, interim biosafety frameworks, NBFs that are 'work-in-progress' to a category of countries without NBFs.

However, even in the presence of guidelines and frameworks, many countries still have limited capacity to deal with various issues related to agricultural biotechnology, including intellectual property, inspection and compliance monitoring issues.

One pertinent issue facing biotechnology development is the issue of strict liability, specifically the potential liabilities for transgenic crops. This refers to the no fault liability of the producer or user of transgenic crops in case these should be shown to cause damage to another person or property.

To opponents of GM technology, there is likelihood of transgenic crops causing harmful long term health or environmental effects, when pollen flows from transgenic crops to non-transgenic crops, ruining the 'organic' status of non-transgenic crops or the purity of the genetic material of non-transgenic seeds.

Though the scientific basis of such an eventuality has not yet been proven, some biosafety legislations in certain countries give persons who believe their land or crops have been damaged by a neighbour's transgenic crops the right to bring a claim in strict liability or responsibility.

While such provisions encourage developers of transgenic crops to adopt appropriate scientific safeguards and effective technology stewardship procedures, strict liability and redress provisions have led to the increased use of indemnification and warranty disclaimer provisions by agricultural technology donors.

Such strict liability provisions can serve as a disincentive to technology developers including potential technology and even financial donors to African agricultural research. This is especially of concern in Africa, where liability insurance for transgenic crops is not widely available and the costs of such insurance or compensation fund could increase operational costs and product costs.

To fully prepare to access and utilise the benefits of biotechnology, many countries will need to invest in human resource and facilities to handle innovative technologies and institute proactive advocacy and education of policy and decision makers.

While the regulatory challenges have myriad perspectives including those of product developers and legislators, the urgent need is for the enactment of policies that effectively regulate but do not prevent access to appropriate and useful technologies by African farmers.

Partnerships between technology developers, regulators and the public will be crucial in achieving responsible and ethical management of biotechnology products right from their development through to their ultimate use.

Responsible Management of Intellectual Property in Agriculture

An Effective Engine for Agricultural Technology Transfer

Years ago, agricultural research was mainly carried out by public sector institutions and universities, who were the leaders in developing improved crop varieties. These products were then transferred to farms through cooperative extension services, as a public good.

Ms Irene Kitsara (left), the Project Co-ordinator, Patent Information Service at WIPO, visited AATF for consultations with staff following the signing of the AATF/WIPO memorandum of understanding.

However, over the last few decades, the products developed through agricultural research have increasingly been treated as private goods and protected through various forms of intellectual property (IP).

Because developing such goods usually requires a great deal of time and financial investment, the creator usually seeks a return on his effort by acquiring IP rights. The rights also allow the creator to restrict the use of his or her intellectual property.

In agriculture, the concept of IP is well established, for instance through patents on farm machinery. A patent is an exclusive right provided to an inventor that excludes all others from making, using and/or selling a particular invention. Once issued, a patent gives the inventor the legal right to create a limited monopoly by excluding others from creating, producing, selling or importing the invention.

This right is for a period of 20 years from the date of filing the patent application. In exchange for the right of exclusion, the inventor must disclose all details describing the invention, so that when the 20-year patent right expires, the public may have the opportunity to develop and profit from the use of the invention.

TANZANIA. Nearly every aspect of the Swahili culture has been greatly influenced by the Arabic culture, including their clothing. An example is the *buibui*, the long black dresses worn by these two women; their heads are covered with *hibajus*.

In relation to plants, the plant variety protection (PVP) system, which is also referred to as plant breeder's rights, allows plant breeders to protect new plant varieties for specified terms. PVP and patents are the most commonly used and also the most controversial types of protection in agricultural biotechnology.

PVPs are less expensive than patents and, for applicants as well as administrators, they are less complicated to handle. They also provide more liberal exemptions (farmer-saved seed) than patents. Therefore, PVPs tend to be the more preferred form of IP, especially in developing countries.

The World Trade Organization's Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement is the most comprehensive agreement on IP rights and has inspired the passage in Africa of national IP legislation on new plant varieties, patents, trademarks and copyright.

TRIPS requires that 'patents shall be available for any inventions, whether products or processes, in all fields of technology'. However, this agreement allows countries to exclude from protection 'plants and animals other than microorganisms'.

Some African countries are party to TRIPS, but many of them lack the expertise to draft appropriate legislation (PVP or patents) and begin administering such systems. African countries are concerned that new technology will be held solely by multinational companies and will be inaccessible or unaffordable to them. They also question the ethics of protecting, or 'owning', living organisms.

On the other hand, with appropriate IP systems, developing countries stand to benefit from the protection of their genetic resources and may be able to encourage investment in the plant breeding industry and to attract international collaborators.

One of the enduring questions, especially in Africa, is whether the IP rights, which are predominantly owned by the private sector, lead to the monopolisation of seeds, research tools, and even knowledge.

In addition, agricultural systems in many developing countries are eager to determine whether IP rights will promote research and development by providing incentive for investment and encourage access to inventions produced elsewhere.

The emergence of modern IP legislation in Africa serves as a stimulus for agricultural technology transfer because under the provisions of such legislation any unauthorised use of an IP right during the period of protection would constitute an infringement.

There is now an increased need for agricultural institutions in Africa to formulate IP policies that set clear objectives and principles of conduct in obtaining access to and use of IP. The IP policies should establish guidelines as to how and when IP protection will be sought and exercised. The policies would also address the issue of ownership of the IP output of a collaborative agricultural research project.

Publicly funded research institutions should build up their capacity to manage the intellectual property that they either procure or generate. Knowledge of IPRs will help scientists from developing countries to determine if information about a particular technology is already part of the public domain and therefore freely available.

Moreover, IPs generated by the public sector can be considered as assets that can be exchanged for private sector-owned IPs or used to bargain technology transfer negotiations. Partnership between the private and public sectors in technology development through sharing of knowhow and IP can hasten technology transfer and acquisition on both sides.

Responsible IP management can be an effective engine for agricultural technology transfer.

Building Trust in Public-Private Partnerships

Enhancing Performance and Effectiveness

Dr Stephen Misari (in red shirt), the Cowpea Project entomologist, discussing the *Bt* cowpea.

Increasingly, farmers, especially in developing countries, are facing more and more threats to their ability to feed themselves and their families. This underlines the need to build broader, deeper and more effective partnerships that improve the effectiveness of the global food chain and offer farmers the opportunity to produce and earn more.

The onus of creating effective environmental and agricultural regulations, building investor confidence, prioritising public investment and building the infrastructure that connects farmers to the broader economy lies squarely on governments. Yet, despite agriculture being at the heart of many African economies, public agricultural investment has often been relegated in economic planning. By contrast, the private sector players possess the knowledge and the technology to support farmers as their customers and partners, thus helping them better benefit from research.

It has therefore been recognised that the public and private sector need to capitalise on mutual strengths to accelerate the process of development and field deployment of technologies for the benefit of resource-poor farmers.

Partnerships between the private sector, which has proven capacity to bring technologies to farmers (in the form of seeds and other agricultural inputs), and the public sector, which has capacity for agricultural research and local expertise and knowledge, are therefore central to attaining the agricultural goals of food sufficiency and improved livelihoods for Africa.

NIGERIA. The loose fitting shirt worn by this street musician from Shinkafi, a town in Zamfara state in northern Nigeria, is called a *buba*. The *fila* is a traditional cap worn by Nigerian men.

While these partnerships have the potential to respond to wide-ranging global challenges by combining resources and expertise, experience has shown that success depends on meticulous handling of subtle and potentially fragile legal, confidential, ethical and social-cultural elements. Indeed, mistrust among private and public sector stakeholders about each other's motives and capabilities in carrying out humanitarian projects is a major hurdle to successful partnerships between the two sectors.

There have been attempts in recent years to work on thawing the ice, and public-private partnerships (PPPs) are increasingly becoming an effective means to this end. The idea is to capture the synergy of public and private sector organisations that work together towards shared goals.

Mistrust in PPPs

PPPs for agro-biotechnology face their own peculiar challenges and complexities, mostly brought on by controversy around genetically modified (GM) crops and the widespread skepticism about private sector involvement.

Distrust has been identified as one of the major challenges to the success of PPPs[1], which often stems from public misconceptions about the intentions of the private sector's involvement[2] and from public and private culture clash within the partnership. An inability to secure trust among partners of a PPP and between the project and the public can pose a great risk to the success of a PPP, and ultimately can result in failure of the development initiative[3].

In a survey of key informants from PPPs involving the Consultative Group on International Agricultural Research (CGIAR) centers and multinational agricultural research firms, 40% of respondents believed that distrust and suspicion was a primary impediment to the formation of greater partnerships[4].

There are contentious issues concerning human and animal health, preservation of biodiversity and indigenous crops, regulation of new technologies and power relations between multi-national corporations and small-scale farmers.

These complexities are further enhanced by the numerous stakeholder groups, the number of national governments involved,

1 Edelenbos J and Klijn EH. 2007. Trust in complex decision-making networks: A theoretical and empirical exploration. *Administration and Society* 39 (1): 25–50.

2 De Costa A, Johansson E, Diwan VK. 2008. Barriers of mistrust: public and private health sectors' perceptions of each other in Madhya Pradesh, India. *Qual Health Res* (Available from http://www.ncbi.nlm.nih.gov/pubmed/18503017). 2008 June, 18 (6): 756–66.

3 Ezezika Obidimma C, Thomas Fiona, Lavery James V, Daar Abdallah S, Singer Peter A. 2009. A Social audit model for agro-biotechnology initiatives in developing countries: Accounting for ethical, social, cultural, and commercialization issues. *Journal of Technology Management & Innovation*, 4 (3): 24–33.

4 Spielman D J and von Grebmer K. 2006. Public–private partnerships in international agricultural research. *Journal of Technology Transfer* 31 (1): 291–300.

multiple research institutions, resource sharing and intellectual property rights issues.

Trust-building model

The McLaughlin-Rotman Centre for Global Health at the University Health Network and the University of Toronto Canada have developed a trust-building model to address risks for agro-biotechnology PPPs associated with public distrust. In the model, an audit team collects, analyses and interprets descriptive, quantitative and qualitative information. The information is gathered to produce an account of a project's ethical, social, cultural and commercialisation performance and impact. The end goal is to help foster better management practices, accountability and transparency, which in turn will help to build trust between project partners and the public.

The Water Efficient Maize for Africa (WEMA) is the first project to carry out an audit of this kind in the South. To implement it, stakeholder groups were identified for inclusivity and they were engaged in designing the questionnaires and pilot testing of tools that would be used in the social audit. The social audit of the project is carried out through stakeholder interviews, whose findings, together with those from focus groups and project meeting reports, are analysed and reported in a social audit report. The report is presented to and discussed with project management, governance and funders, and shared publicly with the project stakeholders. In the final stage of the model, we see the impact of communicating the audit information through improved management practices, holding project management accountable to project funders, and ensuring transparency of the project to all stakeholders. Communication and accountability are treated as central at all levels of the model.

Building trust and enhancing performance

Application of the model to the WEMA project has been regarded by WEMA Project teams, management, and funders as effective in terms of building trust among the project partners and between the project and the public. This is due to the creation of a climate of accountability and transparency on ethical, social and cultural issues.

Applying the model enabled the project to account for the ideas and concerns of all parties involved in the agro-biotechnology PPP, and ensure that these groups were all informed of the issues that arose and how they would be addressed in the project. The combination of accounting for all parties' viewpoints and disseminating the key findings of this information to all parties involved in the project provides transparency and accountability, and ultimately helps to align the various parties' goals and interests—which would otherwise not have been openly communicated and negotiated.

Perspectives from stakeholders

In an online survey carried out during the year on the effectiveness of the model in building trust in the WEMA project, stakeholders indicated that the social audit findings adequately reflect the issues expressed by WEMA stakeholders.

The social audits were reported as successful in providing opportunities for WEMA stakeholders to openly express their views on the project. The majority of the respondents rated the social audits as 'very good' or 'excellent' in this regard.

The provision of transparency about the WEMA project through the social audit findings was considered very high. One stakeholder stated:

'The social audit has transformed the thinking of project implementers with regard to their perception of the important role of stakeholders towards the successful implementation of the WEMA project.'

Creating a future of effective and accountable PPPs

As PPPs become a common avenue for bringing cutting-edge innovations to the public, it is imperative that they are effective and sustainable. A key ingredient to achieving this effectiveness and sustainability comes through trust-building, which is a complex endeavour, laden with ethical, social, and cultural challenges. The model helps address these challenges in PPPs in order to build and sustain trust, and can be applied to a variety of global development PPPs due to the flexibility in the design of the model and the potential to tailor its tools to varying project needs.

OFAB Chapters Reflect on Success, Challenges and Lessons

Defining Future Direction

The Open Forum on Agricultural Biotechnology in Africa (OFAB) continues to play a crucial role as a platform for deliberations on agricultural biotechnology in the continent. In November 2010, OFAB held its first continental consultative meeting that brought together its five chapters. The meeting provided a learning, planning and experience-sharing opportunity for the Forum partners.

OFAB was initiated by AATF in 2006 to enhance the awareness, sharing of knowledge and level of understanding on biotechnology in general, and its agricultural component in particular. The ultimate goal of OFAB, which brings together key players including scientists, journalists, policy makers, civil society and farmers, is to contribute to a conducive environment for decision-making on agricultural biotechnology.

OFAB is currently operational in Kenya, Uganda, Tanzania, Nigeria and Egypt. The Forum's activities are managed by different government agencies and public institutions in the respective countries in partnership with AATF. In Kenya, AATF has partnered with the International Service for the Acquisition of Agri-biotech Applications (ISAAA-Africenter). The Uganda chapter is administered in collaboration with the Uganda National Council for Science and Technology

TOP: Participants to the consultative meeting of the OFAB chapters held in November 2010 in Nairobi, Kenya.

BOTTOM: A section of OFAB Nigeria chapter participants keenly follow the proceedings.

TANZANIA. From the earrings worn by this Samburu woman, one can see that she has a circumcised son. The colour red is of particular significance and is associated with social transitions, blood and sensuality.

(UNCST). The Nigerian National Agricultural Biotechnology Development Agency (NABDA) and the Tanzanian Commission for Science and Technology (COSTECH) assist in the running of the chapters in their countries. The Programme for Biosafety Systems (PBS) continues to support OFAB work in Kenya, Uganda and Nigeria while the Agricultural Research Council of Nigeria (ARCN) supports NABDA in Nigeria.

Defining the way forward

In November 2010, 20 representatives convened in Nairobi for the first ever consultative meeting of the OFAB chapters. The main aim of the three-day meeting, which was organised by AATF and ISAAA, was to evaluate the performance of OFAB since its inception. The participants presented the progress in their respective countries, highlighting achievements, challenges, lessons learnt and innovative approaches applied during the year. These discussions confirmed the continued relevance of OFAB and, more importantly, informed the future direction for OFAB.

The meeting concluded that all indicators support the need to enhance OFAB's effectiveness by strengthening it and expanding its activities within the countries where it is currently operational and also across Africa. The participants felt that these goals could be achieved by enhancing the governance systems of the country chapters and introducing additional meetings and activities outside the main cities. As a way of enhancing biotechnology communication, the participants suggested strengthening the skills of scientists to communicate with the general public. They also proposed that journalists require support, to enable them report on biotech issues in an accurate and balanced way. The meeting also flagged the need to promote the participation of women in discussions on biotechnology at country-level, as well as their leadership capabilities within OFAB.

Resource mobilisation

The strongest endorsement for OFAB in 2010 was the grant of US$ 2000,000 by the Bill and Melinda Gates Foundation to cover the Forum's activities in 2011. This support increased the confidence of OFAB partners in the Forum and ensured that momentum gained during the four years would be maintained.

Country updates

The OFAB monthly meetings continued in the chapters, in line with the overall goals of OFAB, based on the respective country needs and interests. The views shared during these forums, which attracted the participation of high level government officials, contributed to the national agendas on biotechnology.

The OFAB Nigeria chapter organised a special media event where journalists and scientists discussed agricultural biotechnology and its role in the country's agricultural development. The session also deliberated the potential benefits of modern biotechnology for national development, as well as issues related to the regulation of biotechnology.

In Kenya, OFAB focussed on various topics, including the progress made in biotech projects, such as the research on *Bt* cotton. The Forum also discussed the role of biotechnology and the challenges regarding its commercialisation and the role of the media in the process.

In Uganda, the major area of focus was the scope of biosafety and biosecurity in medical and other scientific laboratories dealing with infectious agents in the country. The chapter also discussed the application of biotechnology tools to combat the cassava brown streak disease epidemic that has re-emerged in the country.

The OFAB chapter in Tanzania discussed concerns around accessibility of biotech seeds and the capacity of local scientists to use biotechnology. They also looked at how public awareness and education on biotechnology could be enhanced.

During the short time that OFAB has been in operation, it has continued to register progress and growth in the countries, remaining focused on its key role of providing a platform for stakeholders to openly discuss biotechnology issues based on their country needs and interests.

Financial Report

This audited financial statement covers January 2010 through December 2010 and provides comparative data for the 2009 accounting period.

Funding overview

In 2010 the main financial investors of AATF included:

- Bill & Melinda Gates Foundation
- Department for International Development (DFID), UK
- Howard G. Buffett Foundation
- United States Agency for International Development (USAID)

The Foundation is grateful to them for their continued and consistent support.

Financial health

The financial health of the Foundation improved as compared to the previous year as shown by the self-explanatory figures above. The Foundation's activities in 2010 resulted in a $0.5 million surplus as compared to a deficit of $1 million in 2009. The Foundation received an unqualified audit report and the independent auditors' opinion on the Foundation's 2010 accounts was that:

'In our opinion the accompanying financial statements give a true and fair view of the state of financial affairs as at 31 December 2010 and its surplus and cash flows for the year then ended in accordance with International Financial Reporting Standards … In our opinion proper books of accounts have been kept by the Foundation, so far as appears from our examination of those books …'

Statement of financial position as at 31 December 2010 (US$)

	2010	2009
Assets		
Non-current assets		
Equipment and motor vehicles	111,500	157,634
Intangible assets	1,693	1,359
	113,193	**158,993**
Current assets		
Grants receivable	280,360	232,627
Other receivables	287,431	261,388
Bank deposits	2,010,259	4,000,000
Bank and cash balances	2,306,114	2,176,994
	4,884,164	**6,671,009**
Total assets	**4,997,357**	**6,830,002**
Liabilities and fund balances		
Current liabilities		
Unexpended grant payable	2,705,628	5,109,739
Payables and accruals	324,669	304,874
	3,030,297	**5,414,613**
Deferred income	37,811	0
Fund balances	1,929,249	1,415,389
Total liabilities and fund balances	**4,997,357**	**6,830,002**

Statement of comprehensive income (abridged version in US$) for the year ended 31 December 2010

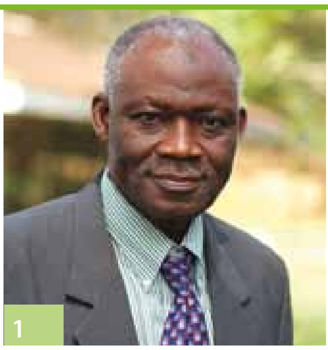
	2010	2010
Income		
Grant income *	12,165,298	9,514,286
Other income	96,001	2,802
Total income	**12,261,299**	**9,517,088**
Expenditure		
Project related expenses	10,166,966	8,977,526
Management and general expenses	1,580,474	1,553,286
Total expenditure **	**11,747,439**	**10,530,811**
Surplus/(deficit) for the period	**513,860**	**(1,013,723)**
Percentage of management and general expenses to the total operating expenses	13.45%	14.75%
Percentage of project related expenses to the total operating expenses	86.55%	85.25%
	100%	**100%**

* The total grant income rose to $12.2 million as compared to $9.5 million in the year 2009. This increase is mainly as a result of an additional grant of £2,500,000 by DFID to support core activities that were previously covered by the Rockefeller Foundation's grant. The rise is also due to the recognition of an unexpended grant amount of about $5,000,000 that was deferred from 2009. However, during the year there was a reduction of $4,691,171 of the Bill & Melinda Gates Foundation's grant to the Water Efficient Maize for Africa (WEMA) Project.

** During the year, the AATF project activities increased, leading to a rise in project related expenses to $10.2 million as compared to $9 million in 2009. However, the management and general expenses remained relatively constant as compared to the previous year resulting in an improved ratio of 'management and general expenses' as a percentage of the 'total expenditure' to 13.45% from 14.75% in 2009. The 'project expenditure' ratio as a percentage of the 'total expenditure' stood at 86.55% and 85.25% in 2010 and 2009 respectively.

AATF Board Members 2010

1. Walter Alhassan (Board Chair). Coordinator, Agricultural Biotechnology Support Project II (ABSPII) West and Central African Sub-regional Coordinator, Programme for Biosafety Systems (PBS) Accra, Ghana
2. Idah Sithole-Niang (Board Vice Chair). Professor, Department of Biochemistry, University of Zimbabwe
3. Kevin Nachtrab. Senior Patent Counsel, Johnson & Johnson, Belgium
4. Michio Oishi. Director, Kazusa DNA Research Institute, Kazusa-Kamatari, Kisarazu, Chiba, Japan
5. Gordon Conway. Professor of International Development, Centre for Environmental Policy, Imperial College, London, UK
6. Peter Matlon. Adjunct professor, Department of Applied Economics and Management, Cornell University, Ithaca, New York, United States
7. Robert Harness (deceased). Independent Consultant, Biotechnology Policy
8. Josephine Okot. Managing Director, Victoria Seeds Ltd, Kampala, Uganda
9. Mariame Maiga. Rural Development Sociologist, Development Policy and Project Analyst, Gender Specialist
10. Wilson Songa. Agriculture Secretary, Ministry of Agriculture, Nairobi, Kenya
11. Daniel Mataruka. Executive Director, African Agricultural Technology Foundation, Nairobi, Kenya
12. Adrianne Massey. Principal, A Massey & Associates, Chapel Hill, North Carolina, USA
13. Alhaji Bamanga Tukur. Group Chairman, BHI Holdings Limited (Daddo Group of Companies), Lagos, Nigeria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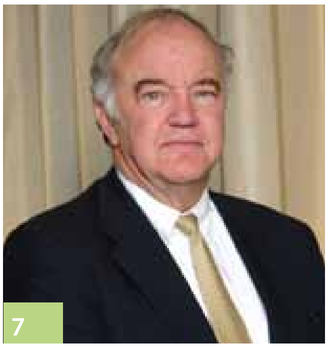
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AATF Staff 2010

1. Daniel Fungai Mataruka. Executive Director*
2. Hodeba Jacob D Mignouna. Director, Technical Operations/ Acting Executive Director
3. Moussa Elhadj Adam. Director, Finance and Administration
4. Alhaji Tejan-Cole. Legal Counsel
5. Francis Nang'ayo. Regulatory Affairs Manager
6. Gospel Omanya. Seed Systems Manager
7. Nancy Muchiri. Communications and Partnerships Manager
8. Nompumelelo H Obokoh. Project Manager Cowpea
9. George Marechera. Business Development Manager
10. Sylvester Oikeh. Project Manager, WEMA
11. Peter Werehire. Publications and Websites Officer
12. Grace Wachoro. Project Communications Officer, WEMA
13. Umaru Abu. Communications/Admin Officer, West Africa
14. Jacquine Kinyua. Executive Assistant to the Executive Director
15. Stella Simiyu-Wafukho. Programme Officer, Regulatory
16. David Tarus. Programme Assistant
17. Martin Mutua. Accounting Officer*


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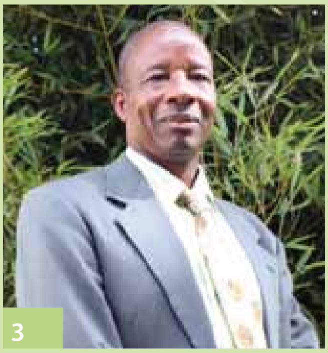

18. Amos Kimebur. Accounting Officer
19. Maurice Ojow. Project Accountant
20. Caroline Thande . Administrative Assistant, WEMA
21. Nancy A Okita. Administration/Human Resource Associate
22. Fatuma Wario. Administrative Assistant/ Events Coordinator
23. Gordon Ogutu. Protocol and Liaison Assistant
24. George Njogu. Driver

*Left in 2010

African Agricultural Technology Foundation
PO Box 30709 – 00100
Nairobi, Kenya
email: aatf@aatf-africa.org • website: www.aatf-africa.org

Telephone and Fax:
Direct
Switchboard: +254 (0)20 422 3700
Fax: +254 (0)20 422 3701
Via USA
Phone: +1 650 833 6660 3700
Fax: +1 650 833 6661 3701