

AFRICAN AGRICULTURAL TECHNOLOGY FOUNDATION FONDATION AFRICAINE POUR LES TECHNOLOGIES AGRICOLES

WORLD-CLASS TECHNOLOGIES FOR FARMERS IN SUB-SAHARAN AFRICA







World-Class Technologies for Farmers in Sub-Saharan Africa

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Contents



AATF: Sr	apshot by Numbers	vii
The AAT	F Model: A pipeline of solutions	ix
African /	Agricultural Technology Foundation: The Art of the Deal	х
A word f	rom Dr. Eugene Terry, Implementing Director of AATF	xii
Message Professo	e from the Board Chair and Executive Director or Idah Sithole-Niang, Dr. Denis T. Kyetere	xiv
World-cl	ass technologies for farmers in Sub-Saharan Africa	
٢	Controlling a lethal flower:	
	The Striga Control in Maize Project	1
•	Little rain? No problem!	

8

12

16

20

Wo

The Water Efficient Maize for Africa Project

The Pod-borer Resistant Cowpea Project

The Bacterial-Wilt Resistant Banana Project

0	Breeding better rice for Africa:
	The Hybrid Rice Project

Defeating a crop spoiler:

Towards a tougher banana:

Rice that thrives

on less water and on depleted soils:

The Nitrogen-Use Efficient, Water-Use Efficient and

- Salt-Tolerant Rice Project
- Fighting fungus with fungus:
 The Aflatoxin Control in Maize and Peanuts Project

24

28

42

45

45

46

48

49

- Cashing in on cassava with mechanisation:
 The Cassava Mechanisation and Agro-processing Project
 32
- Information for progress:
 The Open Forum on Agricultural Biotechnology in Africa
 38
- The right seeds at the right time, place, and price: The Seed2B Project

Special projects

- The Africa Biofortified Sorghum (ABS) Project
- Commercial Products II (COMPRO II) Project
- Forum on China-Africa Co-operation (FOCAC)

AATF project countries







Number of countries that host **OFAB** chapters

be fed with the use of droughttolerant, pest-resistant maize

in maize and groundnuts from using biocontrol technology in Nigeria

vii

seed market in SSA (excluding

South Africa)

"One of the things that I think is fabulous about AATF is that they really provide a vital service to a lot of the national research programmes across Sub-Saharan Africa. They focus on getting access to these technologies in a way that allows these national research programs to focus on their core competencies – actually doing research on bringing these technologies forward. AATF makes that job easier for them."

- John McMurdy, International Research and Biotechnology Advisor, USAID





and also SMS networks so farmers instantly find farming tips and market prices

African Agricultural Technology Foundation: The Art of the Deal

What do the following have in common?

- A staple consumed by millions of people strangled by a weed that could not be vanquished.
- A bean prized by millions for its high protein content that all too often gets devoured by a caterpillar before harvest.
- The fastest growing staple in Africa but which most African countries import, since the local varieties are low-yielding and difficult to produce.
- A popular food crop that increasingly fails as climate change brings hotter, drier weather to many areas.

All these are major African crops with major problems that require urgent attention in order to meet food security and economic development needs and that AATF is involved in addressing through focused partnerships with technology owners, researchers, agribusiness, and governments. You learn about the crops referred to in the pages in this book.

AATF itself owns no research fields, laboratories or patents. Instead, AATF staff work with more than 80 research, technology, policy, government, and NGO partners to connect ideas and agreements, people and technologies to ensure that what comes out of laboratories can be developed into excellent tools for smallholder farmers in Africa. AATF and partners also ensure that these technologies get approved by policymakers and regulators, get produced by local agribusinesses and are made available to smallholder farmers. This in turn enables farmers to produce high-yielding, high quality staples and other crops and enjoy higher income and food security.

The solutions may be a disease-resistant banana, drought-tolerant maize seed, insect pest-resistant cowpea, special machines for planting and harvesting cassava, a deal with commercial seed companies or a study

tour for policy makers to better understand biotechnology. In each case, AATF is contributing to solving tough problems to help African farmers improve yield, income, and lives.

We focus on more than the value chain. We work on a value "web" linking not only farmers, input dealers and markets – but also research institutes, private companies, technology developers, royalty-holders, machinery assemblers, policy makers, and the media.

We are the "honest brokers": persuading, negotiating, advocating, getting permissions, licensing, sub-licensing, arranging for royalties or royalty-free arrangements.

The following pages introduce ten projects in ten countries, and includes reminiscences on the organisation's founding and thoughts on where it's going.

We hope you enjoy the tour.



"Africa is beset by terrible pests, diseases, weeds, and also by increasing drought. So being able to tackle these issues is what is important... AATF is showing real promise and is a problem solver in bringing innovative technologies to smallholder farmers in an accessible, sustainable form."

> Sir Gordon Conway,
> President of Rockefeller Foundation at the time of AATF's founding.

A word from Dr. Eugene Terry, Implementing Director of AATF



When we started AATF, we were designing a whole new kind of organisation. Nobody had done this before. There was no blueprint, no known set of rules to follow.

People were aware, of course, of the gaps between obtaining results from crop research, and translating these results to the farms of small-scale producers in Sub-Saharan Africa who desperately need better seeds and other inputs. But each organisation had their own role – there wasn't anyone coordinating the whole web of what has to happen to get better tools into farmers' hands.

So the Rockefeller Foundation, the United Kingdom's Department for International Development (DfID) and the U.S. Agency for International Development (USAID) all pledged their support for an organisation that would take on this coordinating role. They worked with the Meridian Institute of the USA to design AATF, and to determine what it would look like in terms of governance, staffing, administration, and the business plan.

When the new organisation needed a director, they said, 'We need someone who is willing to absorb the pain and agony of trying something entirely new for the African continent.' When they described the profile, it was clear they were looking for a 'five-legged sheep.' And they came to me! I was retiring from the World Bank. My first reaction was to decline, but after some reflection and a phone call from an ex-colleague – Peter Matlon who had served as my Director of Research when I was Director General at WARDA – I decided to give it a try. I thought that this could be another voyage of discovery.

And indeed it was!

Our business plan called for us to prioritise areas of serious agricultural productivity challenges, where conventional approaches had failed, and where we believed proprietary technologies from the private sector may be useful. These were challenges for which people had already tried everything in the book, so it was time to try something entirely new. This was the case with certain cassava virus diseases for example. This was also applicable to the control of aflatoxin, and some of the more serious pests of maize – pests that chemicals could not control, and of course chemicals can seriously pollute the environment in any case.

A lot of AATF's work is detective work. When all else has failed, who might have a technology that could do the job? Big technology companies have lots of useful genes that they've extracted, tested, and patented, but are not using right now. But they're very secretive, because they have to guard against giving away their company's intellectual property to their fiercest competitors. But if AATF does proper 'intelligence' work, and can articulate precisely what technologies they require, and the companies are willing to negotiate, then legal discussions can be opened. Would it be royalty-free? What will it take to get a license and sub-license it to scientific partners? Is it time-restricted?

AATF does not focus on one technology. It's really whatever works, wherever it can be found. Cassava production and processing machines from Brazil. Crop-based technologies for rice from Asia or for maize varieties from the Americas. Whatever solves the problem.

We all want AATF to be sustainable for the long run, since tough challenges will always be there. Sustainability for us may depend perhaps on long-term support from the primary beneficiaries, the African states, with interventions from the African Union (AU).

We're proud that AATF is African owned and managed. And I find it very gratifying to have helped set up this mechanism that works.

"AATF is a child of people and institutions of goodwill who understand that partnerships and working together create more power than the sum of the power of each partner put together."

> [–] Dr. Mpoko Bokanga, first Executive Director, AATF

Message from the Board Chair and the Executive Director Professor Idah Sithole-Niang, Dr. Denis T. Kyetere



It's hard to think of a more important mission than the one that AATF has embraced: increasing food security and economic development in Africa by enhancing agricultural productivity.

Agriculture is the backbone of Africa's economic development. Seventy percent of its people depend on it for their livelihood. That's why the African farmer is at the heart of AATF.

AATF is about African farmers and providing them with practical solutions to some of their biggest agricultural challenges. We leverage science and technology to help farmers grow more and better food and reverse the low agricultural productivity trend in Africa that makes it lag behind the global average.



Beyond the technologies themselves, we actively support the development of an enabling environment – regulatory, legislative, infrastructural – which is critical to getting the technologies into farmers' hands. We will continue pursuing our mandate of honest broker between technology owners and users, and also providing information that helps policy makers make informed decisions on science and technology.

One thing we have learned over our 12 years of existence is that our successes come from the support and collaboration of many partners. Some of our esteemed partners have been there from the beginning – the Rockefeller Foundation, the United States Agency for International Development (USAID), and United Kingdom's Department for International Development (DFID). In addition, support from the Bill & Melinda Gates Foundation (BMGF), Howard G. Buffet Foundation, Pepsico and Syngenta Foundation for Sustainable Agriculture (SFSA) has made it possible for AATF to grow. Further, participation and commitment of technology donors,

project partners, African governments and farmers has ensured progress towards realisation of food security and economic development goals.

AATF now collaborates in 11 partnership projects in 13 countries – with over 80 partner organisations. These projects focus on seven areas critical to our farmers in Sub-Saharan Africa: the impact of climate change; pest management; soil management; nutrient enhancement in foods; improved breeding methods, mechanisation; and enabling environment.

We express our gratitude to our investors, partners and staff at AATF. Their contributions are changing the lives of smallholder farmers for the better, one family at a time.

We invite you to read through the 10 projects highlighted in this book and request you to continue partnering with us towards the achievement of a vision of 'A prosperous and food secure Africa.'

Prof Idah Sithole-Niang' Chair, Board of Trustees Dr Denis T. Kyetere Executive Director



The African Agricultural Technology Foundation (AATF) was launched in June 2004 by Kenya's Minister for Agriculture, the Honorable Kipruto arap Kirwa, and the AATF Board Chair, Prof Jennifer Ann Thomson, at a colourful ceremony held at the Foundation headquarters in Nairobi, Kenya.

Harriet Auma Onyango, 19, hopes to enter nursing school soon, thanks to the additional income her family now earns from planting StrigAway maize.

Controlling a lethal flower:

The *Striga* Control in Maize Project

n colonial times, Chiefs in Western Kenya required that farmers pile uprooted Striga flowers on the road in front of their farms to demonstrate diligence in destroying the parasitic weed. Striga literally sucks maize plants dry. Until recently, no maize (corn) variety could withstand the parasite and this threatened the food security and income for more than 100 million people. Now a partnership that aims at controlling the Striga menace in farmers' fields is promoting use of a technology that kills the weed and allows maize to grow to maturity. The technology, known as StrigAway, combines a herbicide that destroys the weed, and a maize variety bred to tolerate the herbicide.

Why we care

When cut and arranged, the delicate violet flowers of the *Striga* weed make a lovely bouquet. Unfortunately, the weed is also a "cereal killer": It sucks the nutrients and water from the roots of maize and other cereal crops and, in addition, secretes a toxin to poison the crops.

Striga thrives in depleted soils, so it hits hardest highly populated areas where plot sizes are small without room for rotation and maize is planted year after year. The weed causes maize losses ranging from 20 percent to even total crop failure.

The *Striga* problem baffled researchers for decades. This is because even when *Striga* is pulled out and cleared, seeds in the soil remain viable for up to 20 years.

What we are doing

A partnership that brings together the African Agricultural Technology Foundation (AATF), the International Maize and Wheat Improvement Center (CIMMYT), the chemical company BASF, seed companies, agro dealers and extension services in Kenya, Uganda and Tanzania is promoting use of StrigAway maize technology, sometime known as "Imazapyr Resistant" or "IR" maize. This is an innovative, dual approach technology combining:

- 1) Maize varieties that thrive even after being coated with Imazapyr herbicide, and
- 2) Low dose imazapyr coating which is absorbed into the maize seedling as it germinates.

When a *Striga* seedling attaches to the roots of a sprouting maize plant, the herbicide kills it. Imazapyr dispersed in the soil also kills the tough *Striga* seeds on contact thus reducing the *Striga* seed bank.

The maize seed was developed by CIMMYT, BASF, Weizmann Institute of Science (Israel), and the Kenya Agricultural and Livestock Research Organisation.

"Striga keeps farmers from benefitting from what they do on their farms."

- Charles Odiero, Extension Officer, AATF Partner OTIT AATF is facilitating the testing and production of the maize seed, as well as its commercialisation and marketing to reach farmers.



Success!

The specially bred and coated maize seed has been tested, approved, and been on the market in Kenya since 2006 under the trade name StrigAway. It has been on the market in Tanzania since 2012 and Uganda since 2014.

StrigAway maize boosts yields dramatically – often 300 percent – and improves incomes by on average US\$ 400 per hectare, per season.

The partnership stewards the seed from testing to production fields, to certification, to seed companies, stockists and farmers. It also tests better soil-management solutions and has procured special seed-coating machines for seed companies. It works with extension services and other organisations to train both agrodealers and farmers on the promise and use of StrigAway maize.

During farmer field days and other activities where the use of StrigAway is demonstrated, partners also encourage the use of methods that enhance soil fertility and crop yields.

A farmer speaks

Monica Akinyi gazes at a good maize cob in her maize field, the stalks now taller than herself.



"A few years ago there was nothing here," she says. "The family planted maize for over 10 years, until the land was exhausted. So we planted cassava for a couple of years until the cassava mosaic virus wiped that out. We went back to planting maize for another couple of years. But we had much Striga and we got only 40 kg from the half acre."

Monica's fortunes turned around after she attended a farmer field day in 2008 organised by AATF partner OTIT – Organisation for Transforming Initiated Technologies. "When I saw the StrigAway seeds, I knew that was what I needed."

Monica was determined to make it work: she planted the StrigAway maize seeds, hand-pulled Striga weeds every two weeks and intercropped beans for nitrogen to continue the job.

From harvesting 40 kg, her yield became 450 kg (about five 90 kg bags) the first season, then 900 kg (about 10 bags) the next.

Things are now looking up. All her school-age children are now in school.

Monica is also experimenting with other varieties of maize including DroughtTEGO now that her farm is almost rid of the beautiful killer weed.

In addition, community groups recognise her farm as a model of productivity and pay Monica to explain her "secrets" so they can copy her success.



The Striga Control in Maize Partnership

- AATF oversees stewardship of the StrigAway maize seed technology at agro-dealer and farmer levels to ensure long-term use and benefits to farmers
- BASF donated the IR gene, provides stewardship at seed company level and assists in herbicide registration
- CIMMYT develops adapted and farmer preferred IR maize germplasm
- The Weizmann Institute of Science, Israel assisted in the development of the IR technology
- The Ministries of Agriculture and national research institutes in Kenya, Uganda and Tanzania help test and register the new maize varieties
- Extension service providers assist in the establishment of field demonstrations, capacity building, and outreach and awareness activities
- Seed companies (Kenya Seed Company and Freshco Seeds Ltd in Kenya; Nalweyo Seed Company, Uganda and Tanseed International Ltd and Meru-Agro in Tanzania) produce foundation and certified IR maize seed and oversee its distribution and marketing to agro-dealers and farmers
- Local agricultural NGOs and community based organisations inform and educate farmers about the StrigAway maize seeds and how to best use them

The project is funded by Feed the Future Partnering for Innovation as part of the US government's Feed the Future initiative; the United Kingdom Department for International Development (DFID); and the Bill & Melinda Gates Foundation through the International Institute for Tropical Agriculture and CIMMYT. Initial funding came from the Rockefeller Foundation, DFID and United States Agency for International Development.



Demonstrating the enthusiasm they say they feel for StrigAway seed, farmers near Kisumu, Kenya spontaneously break into dance.







Originally from the Americas, maize was imported to Africa in the 16th century. Today it is a staple food for millions of people in Sub-Saharan Africa.

IORID-CLASS TECHNOLOGIES FOR FARMERS IN SUB-SAHAF

RAN AFRICA

During a field tour, the WEMA fields stand out clearly in regions affected by drought, with maize crop higher than knee-level.

Kanne No problem!

The Water Efficient Maize for Africa Project



aize is on the daily menu of more than 300 million Africans. The problem is that maize depends on rain, which is becoming more erratic and in some places sparse. When rains fail, crops fail, and surviving crops are lure for hordes of hungry insects.

AATF coordinates a public-private partnership that was formed in 2008 called WEMA (Water Efficient Maize for Africa) to develop maize varieties that flourish in the face of both moderate drought and insect pest infestation. Using the best tools available – conventional and marker assisted breeding, plus biotechnology – the project is developing maize varieties that use water efficiently and are insect resistant. Goals include getting the improved seeds to small-scale farmers through local seed companies.

By end 2014, 32 WEMA hybrids had been approved and released in four of the five project partner countries.

Why we care

Although originally from the Americas, maize is now the single most widely grown staple in Africa. Hundreds of millions of small-scale farmers depend on maize for both food and income. When a maize crop fails, people go hungry, food prices rise, and families get poorer.

African farmers, leaders, and scientists have all called for crops that can resist drought and the insects that generally follow to feed on surviving crops.

What we are doing

The WEMA partnership brings together governments, international and national research institutes, African seed companies, extension services and businesses to work on addressing the negative impact of drought and insect infestation on maize. The partnership ensures that quality research is carried out, and that quality and timely products are availed to farmers.

AATF serves as the "honest broker" – making the deals and negotiating licenses, and coordinating project activities to support research, field trials, farmer and policy maker information sharing and education, seed production, approvals by government authorities, commercialisation through seed companies and a myriad other, not so obvious, tasks.

Since no single maize variety fits all locales and farmer preferences, the WEMA partnership has developed a wide spectrum of varieties – over two dozen so far. Most are the result of intensive conventional breeding; others have been designed with the help of "gene markers", which show early whether the desired genes have been passed on. Still undergoing testing are some transgenic or genetically



The WEMA Partnership

WEMA is a public-private partnership coordinated by AATF drawing on its experience in public-private partnership management, technology stewardship, and project management.

- National agricultural research systems contribute their adapted germplasm, expertise in breeding, field testing, seed multiplication and distribution
 - Kenya Agricultural and Livestock Research Organisation
 - Instituto de Investigação Agrária de Moçambique
 - Agricultural Research Council, South Africa
 - Tanzanian Commission of Science and Technology
 - National Agricultural Research Organisation, Uganda
- CIMMYT provides high-yielding maize varieties and inbred lines adapted to African conditions; expertise in conventional breeding and testing
- Monsanto contributes maize varieties, droughttolerant and insect-protection genes, expertise in agriculture research and product deployment
- Seed companies, government agencies, farmer groups and other relevant organisations ensure access by farmers to WEMA varieties

Project activities are funded by the Bill & Melinda Gates Foundation, the Howard G. Buffet Foundation and the United States Agency for International Development. modified (GM) varieties that directly incorporate genes for drought-tolerance and insect protection.

Success!

As of late 2014, the WEMA partnership had produced, certified and released 27 drought tolerant hybrid varieties for farmers to plant.

In fact, WEMA broke a record in 2013: "For the first time in the history of maize research in Africa, a single entity – WEMA – released 16 hybrids in one year," says Dr Sylvester Oikeh, the WEMA Project Manager.

The first WEMA product, conventional drought tolerant maize under the trade name DroughtTEGO[™], is already being sold to farmers by licensed seed companies in Kenya. The first harvest produced on average 4.5 tonnes of maize a hectare compared to a national average of 1.8 tonnes/ha.

In 2013, WEMA won the Notre Dame Global Adaptation Index (ND-GAIN) prize for its contribution to climate adaptation and food security.

What's next

More than 70 new conventional hybrids are in the pipeline of national certification trials for commercialisation approvals in the project countries of Kenya, Uganda, Tanzania, Mozambique and South Africa.

To further strengthen conventional hybrids, some will be enhanced with patented, drought-tolerant and insect-pest resistant genes that AATF has acquired royalty-free for the project.

WEMA researchers estimate that the WEMA hybrids will produce approximately 2 million additional tonnes of maize in the five project countries – enough to feed 14 to 21 million people in the long-term.

An AATF manager speaks

In all parts of Africa, researchers hear: "Our farmers don't want hybrid seeds because if they use them, they will become enslaved to the seed companies."

But on the ground, for the farmers who have planted WEMA hybrids, after planting their own seeds year after year, the difference is clear. They pay for the seed and they state: "It is absolutely worth it!"

It is an injustice to our smallholder farmers to not offer them the best that modern breeding and technology has to offer.

I just visited the field, in a dry place, and the few who had planted WEMA hybrids were the only

farmers around who had maize this year. All their friends and neighbours whose crops have failed altogether are asking: "How come it's only you who has a crop? Where did you buy this seed?"

The WEMA farmers harvested enough to eat and sell to buy other food, such as rice and beans, and even pay school fees.

- Sylvester Oikeh, Project Manager, WEMA

"AATF has been one of the strongest anchors in agricultural technologies and in delivering them to farmers. AATF has been very supportive in Uganda, especially on major commodities."

- The late Dr Emily Twinamasiko, then Director General, National Agricultural Research Organisation, Entebbe, Uganda





The Project expects to have the first pod-borer resistant cowpea seed in farmers' hands by 2017

Defeating a crop spoiler:

The Pod-borer Resistant Cowpea Project



owpea, a legume that was domesticated in Africa some 5,000-6,000 years ago, is still grown widely on the continent. However, a cowpea-loving caterpillar – the pod borer – attacks the crop with zeal and can wipe out up to 80 percent of a farmer's harvest. Insecticides are expensive and come with health risks. AATF is coordinating a public-private partnership that has found a modern solution to this age-old problem.

Why we care

An ancient African crop, cowpea is an important source of protein for nearly 200 million Africans today. It is also a key trade commodity in West Africa.

Africa grows 65 percent of the world's cowpeas.

The cowpea is popular in Africa for its several virtues:

- High protein content (25 percent) plus a variety of vitamins and minerals. The Hausa of Nigeria call it "poor man's meat".
- A legume, cowpea pulls nitrogen from the air into the soil, helping fertilise other crops;
- It's hardy, adaptable, and thrives in tough conditions. The tap-root extends deep into the ground, enabling it to survive most droughts as well as reduce soil erosion;
- While people enjoy the "bean", (technically it's a pea), the plant's stems and leaves become fodder for livestock, providing income for growers.

On farm after farm, though, cowpea harvests are threatened by a number of pests, the most voracious being the pod borer *Maruca vitrata*. A phalanx of these caterpillars can destroy 70-80 percent of a farmer's cowpea crop, feeding mostly on its blossoms and young pods.

Insecticides can fight the pod borer, but at a cost that is prohibitive to most smallholder farmers, and these pesticides are a risk to farmworkers' health and the environment. Despite years of effort by scientists, the *Maruca* pod borer still presented a challenge with no acceptable solution.

What we are doing

AATF coordinates the implementation of a public-private partnership to bring to bear contemporary technology. The partnership is developing new cowpea varieties indistinguishable from the local farmer-preferred types – with the exception of a gene that repels the pod borer.

Under the partnership, AATF negotiates access to proprietary genes, gets the licenses and sub-licenses to partners, and helps with regulatory processes and outreach.



The PBR Cowpea Partnership

- The Network for the Genetic Improvement of Cowpea for Africa, an international research consortium, initiated the development of *Maruca*-resistant cowpea
- Commonwealth Scientific and Industrial Research Organisation, Australia conducts most of the biotechnology research in the lab
- National research programmes assist in agronomic testing, confined field trials and adaptation into local varieties
 - Council of Scientific and Industrial Research-Savannah Agriculture Research Institute (CSIR-SARI), Ghana
 - Institut de l'Environnement et de Recherches Agricoles (INERA), Burkina Faso
 - Institute of Agricultural Research (IAR) and National Biotechnology Development Agency (NABDA), Nigeria
- UK-based Kirkhouse Trust provided the marker-assisted selection technology
- Monsanto has donated the Bt gene for use in the project, royalty-free
- The Program for Biosafety Systems provides technical support and regulatory advice

Project activities are supported with funding from the United States Agency for International Development (USAID). Initial funding to support conceptualisation and implementation came from the Rockefeller Foundation, the United Kingdom Department for International Development (DFID) and the United States Agency for International Development (USAID).



"Maruca-resistant"

"Maruca-susceptible"

Success!

AATF has negotiated the rights to use the proprietary genes royalty-free. It has also worked with national regulatory agencies to be able to use the gene in the lab and plant the transformed cowpea seeds in controlled field trials.

The improved cowpea is now in confined and multi-locational trials in Nigeria, Ghana and Burkina Faso. The Project expects to have the first pod-borer resistant cowpea seed in farmers' hands by 2017 subject to regulatory approvals in the project partner countries.

The genetically transformed cowpea, while identical in all other respects to the varieties that farmers and consumers prefer, is expected to prevent *Maruca*-related losses and boost yields by more than 20 percent.

What's next

The project is now preparing for commercial release and registration of the varieties to make them available to farmers.



An AATF project manager speaks

"Cowpea is an important food crop. If we can get this new seed to farmers, it's going to reduce spraying of insecticide and also increase productivity –meaning it will increase income for farmers while reducing health risks from chemicals.





had stopped growing cowpea altogether because of the Maruca problem. We told him that with this technology, he can get back into cowpea production.

He said that he would be happy to to try it. One could see he was excited about a cowpea seed that could resist the Maruca pod-borer – cowpea is the best source of protein for his family.

I eat and enjoy cowpea every day!"

- Prince Addae, Project Manager, Cowpea

Clones of transgenic banana grow in a tube from a single cell. Such "tissue culture" is demanding but ensures high quality, clean planting material. Most commercial bananas grow not from seeds but from shoots.

a tougher banana:

The Bacterial-Wilt Resistant Banana Project



or over 100 million people in Africa, bananas are more than an occasional treat. They are a staple food and important source of income, especially in East Africa and the Great Lakes region. But in the 21st century, the banana bacterial wilt disease – known as the Banana Xanthomonas Wilt (BXW) – struck, destroying bananas and livelihoods with estimated economic losses of up to \$8 billion. No banana variety is naturally immune, and the wilt disease has no known cure. AATF is collaborating in a partnership with the International Institute of Tropical Agriculture (IITA) and the National Agricultural Research Organisation (NARO), Uganda that is developing a leading-edge biotechnology solution.

Why we care

In 2001, BXW disease emerged in Uganda, then tore through much of East and Central Africa. BXW wilts leaves and kills the plant; farmers must then clear the ground and wait six months before planting banana again or *Xanthomonas* can reappear.

BXW decreases income and food security for approximately 50 million small-scale farmers. The disease has caused an estimated loss of about \$2 to \$8 billion in the region over the last decade.

For a while things were grim: no known banana variety could resist the pathogen (*Xanthomonas campestris pv. musacearum*), nor could any commercial pesticide control the BXW epidemic.

What we have done

Prospects of developing varieties with resistance to BXW through conventional breeding are limited as no source of germplasm exhibiting resistance against the disease have been identified. IITA found that scientists at Academia Sinica in Taiwan had isolated genes from *Xanthomonas*-resistant sweet pepper plants that could be useful in addressing the BXW problem and they requested AATF to negotiate access to the technology. AATF negotiated with Academia Sinica for a license for the genes, and sub-licensed them to the research partners IITA and NARO, who successfully inserted them into banana plants in the biotechnology laboratory.

Success!

The genes worked, and the plants thrived despite being artificially infected with *Xanthomonas*. After testing hundreds of varieties of these transgenic banana plants, scientists found 11 lines that resist the BXW bug completely. Importantly, the transgenics retain the original traits valued by growers and consumers, including size, maturation time and taste.

In a confined field trial in Uganda, all the control plants withered and died, while the transgenics survived. The Uganda field trial is the world's first field demonstration of transgenic control of a bacterial disease in bananas. The results are published in world leading journal, *Nature Biotechnology*.



The BXW Resistant Project Partnership

- AATF accesses the proprietary genes and sublicenses them to partners
- Academia Sinica donated the plant ferredoxin like protein (*Pflp*) gene and hypersensitivity response assisting protein (*Hrap*) gene isolated from sweet pepper
- IITA is leading product development and biosafety research and developing transgenic lines using varieties preferred in Kenya
- NARO is developing transgenic lines using varieties preferred in Uganda and conducting confined field trials in Uganda
- Kenya Agricultural and Livestock Research
 Organisation will also conduct confined field trials;
- Other partners include public and private tissueculture laboratories in the Great Lakes region of Africa (Burundi, Democratic Republic of Congo, Kenya, Rwanda, Tanzania and Uganda)

The project is funded by the United States Agency for International Development (the majority of research is funded by USAID directly). It also receives funding from the United Kingdom Department for International Development (DFID) for intellectual property management, research and development and capacity building. The project has previously also received funding from the Gatsby Foundation.

What's next

The partners are now testing 10 lines of two BXW-immune varieties for the best yield and trait stability. AATF will establish public-private partnerships with tissue-culture companies to produce the winning varieties at scale and get seedlings into the hands of eager farmers.

At the same time, AATF is working with governments to shape policies and regulations that allow farmers to grow these transgenics while assuring quality and safety.

Testing, regulating, and producing biotech crops are long, complex processes. BXW-resistant banana seedlings are expected to be commercially available around 2020.



East Africa grows over 16 million tonnes of bananas and plaintains a year – about 20 percent of the world's output.

A IITA project manager speaks



In an experimental greenhouse, IITA scientist and Project Principal Investigator Leena Tripathi contrasts the fate of a non-transgenic banana, completely withered, with that of the flourishing plant behind it--the same variety but modified with Xanthonomas-resistant genes.

Banana is an important food and cash crop in the Great Lakes region of East Africa. Banana Xanthomonas wilt disease is threatening banana production and the livelihoods of smallholder growers in East and Central Africa, and solutions have to be found fast before it further destabilises food security in the region.

We have established proof of concept demonstrating field based resistance to banana bacterial wilt disease. These technologies look so promising that we would like to move to multi-locational field trials to test our resistant bananas in different environmental conditions. Such resistant varieties would enhance production of banana and plantain; and save livelihoods in Africa, where the green revolution has had little influence.



"The day bacterial-wilt-resistant plants will be available to rural farmers will be as much a landmark for me as it will be for them. As an agricultural scientist, I think there is no greater joy than helping improve food security and the incomes of one's people. I know that bananas which are resistant to bacterial wilt will achieve these two goals for the people of East Africa."

> - Leena Tripathi, Senior Scientist, Project Investigator, Banana Project

In preparation for commercial release, the hybrids produced will be tested further in on-farm trials before the varieties are released commercially.

Breeding beiter rice for Africa:

The Hybrid Rice Project frica is the world's largest importer of rice. Rice consumption has been growing at close to six percent a year – more than double the population growth rate. Many African farmers are reluctant to grow rice because of discouraging yields. AATF is collaborating in the Hybrid Rice Project that is working to improve both yield and quality of local rice by determining the precise relationships between genetics, environment, and yield, to produce varieties that work well in particular places.

The partnership has developed the first hybrid rice varieties ever bred for Africa in Africa. AATF is also helping develop rice agro-businesses so that African seed companies can produce and sell more rice hybrids to farmers.

Why we care

Citizens of more than 40 African countries grow and eat rice, and over 20 million smallholder farmers depend on it as their main food. But yield is low – on average about two tonnes a hectare compared with the world average of over three – constraining the food security and incomes of farmers, and keeping prices relatively high for urban consumers.

African farmers have cultivated African rice for over 3,500 years, and Asian types for about 2,000. However, while the Green Revolution vastly improved yields in Asia, until recently little work had focused on improving rice grown in Africa using the hybrid technology.

What we are doing

The Hybrid Rice Partnership Project was formed in 2012 and is being implemented in Kenya, Tanzania and Mozambique. The partnership uses sophisticated though "conventional" methods to create hybrids that best suit farmers and consumers here. The project is aiming for a yield of at least 1 tonne per hectare more than the best varieties currently in the market – some of the hybrids currently on field trials produce considerably more than that.

The origins of the parent plants read like a United Nations of rice, since researchers searched the planet for plants with the best traits for African contexts. For instance, some varieties of African and African-Asian blends came from the Lake Victoria Basin Development Authority. Several varieties of NERICA (New Rice for Africa) – a hybrid of African and Asian varieties – were donated by the Africa Rice Centre, Benin. Other parent stock came from Asia and even the Americas.

In addition to creating high-quality, high-yield hybrids, the partnership is working with local researchers, seed producers and marketers to expand rice production and marketing as a vibrant agribusiness.



The Hybrid Rice Partnership

- AATF coordinates the project facilitating links between researchers and the African seed sector, and ensuring that the outputs contribute to global public goods
- HEAL (Hybrids East Africa Limited), based in Kenya, is developing, testing, and distributing the rice hybrids and hybrid parent lines
- aWhere, Inc., USA, is applying climate data and other "location intelligence" so that hybrids are precisely adapted to particular farm conditions
- The Ministries of Agriculture and the national research institutes of Kenya and Tanzania are helping with development and testing
- The Ministry of Agriculture of Mozambique has recently joined the project

Project activities are supported with funding from the Bill & Melinda Gates Foundation.

Success!

After two years of breeding, researchers have produced thousands of hybrid genotypes or "lines" that display the desired traits of high yields, rapid maturity, multiple disease- and pest-resistance, and good grain quality and aroma.

The project has also conducted trainings for crop breeders and seed companies in Kenya and Tanzania. It has also facilitated testing of the project materials by national programmes and private seed companies.

By end 2014, 132 hybrid lines were being tested in 30 locations in Kenya and Tanzania by eight private seed companies and national research programmes.

What's next

In preparation for commercial release, the hybrids produced will be tested further in on-farm trials before the varieties are released commercially.

The project aims to reach 150,000 farmers in Kenya and Tanzania within five years, and 500,000 in the next ten years.





The eating habits of people are changing. Many families are eating more rice, especially as they move to the city and buy their food. We need to grow it instead of importing most of it.

"Whenever I meet rice farmers, they ask me for seeds. We can't share them yet, since they're not yet approved by KEPHIS [the Kenya Plant Health Inspectorate Service]. I can tell you that rice farmers are really eager to get these hybrids."

- Grace Asimwe, researcher with Hybrid East Africa Ltd



The NEWEST rice will feature the taste, aroma, and growth traits that people like to plant and to eat, with just the special genes added.

Rice that thrives on less water and on depleted soils:

The Nitrogen-Use Efficient, Water-Use Efficient and Salt -Tolerant Rice Project



troll through a city market in Sub-Saharan Africa and you may find over a dozen types of rice. It's an increasingly popular staple, the fastest growing food purchased here. Much of it, however, is imported from Asia. Sub-Saharan African countries spend more than US\$ 5 billion annually in foreign exchange on rice imports.

To develop rice varieties that yield well in nitrogen depleted and salty soils and use available water efficiently in tough African conditions, a project partnership known as the Nitrogen-Use Efficient, Water-Use Efficient and Salt-Tolerant Rice (NEWEST) was formed. AATF negotiated access to proprietary genes for drought tolerance as well as those with an ability to thrive in nitrogen-depleted and salty soils. With these genes, partner researchers at Arcadia Biosciences in California have produced dozens of lines of high-yielding, transgenic rice, which are being tested in Africa and ready for breeding/combining with locally preferred varieties to suit local conditions and markets.

Why we care

The Green Revolution dramatically lifted rice yields in Asia but not in Africa where conditions are different and indigenous rice is "upland", growing without flooding. Although demand is steadily rising, few farmers find it profitable to grow rice, so in some countries most of the rice is imported – burdening consumers as well as foreign exchange reserves.

What we are doing

While the Hybrid Rice Project uses conventional breeding techniques to boost rice production in wetter areas, the NEWEST project is using biotechnology to transform upland rice types to thrive in drier environments and nutrient depleted, saline soils.

The project is working with NERICA 4 (New Rice for Africa), a rice variety developed by Africa Rice Centre, Benin and transforming them into the desired rice types.

Partner researchers at Arcadia Biosciences in California, USA then added genes from barley, arabidopsis and bacteria – genes that had been isolated and patented.



NEWST Rice Project Partnership

- AATF is managing the implementation of the project and providing technology stewardship
- Arcadia Biosciences is donating the Nitrogen Use Efficient, Water Use Efficient and Salt Tolerant trait technologies, producing transgenic plants and providing technical support
- Public Intellectual Property Resource for Agriculture (PIPRA) is donating the enabling technologies for plant transformation
- International Centre for Tropical Agriculture (CIAT) is carrying out seed increase, preliminary agronomic trials and field testing for trait gain
- National agricultural research partners

 National Agricultural Research
 Organisation, Uganda; Crop Research
 Institute, Ghana; and National Cereal
 Research Institute, Nigeria are involved in
 field testing for trait gain

Project activities are supported with funding from the United States Agency for International Development (USAID). Initial funding to support conceptualiastion and implementation came from the United Kingdom Department for International Development (DFID) and the United States Agency for International Development (USAID).

Success!

AATF negotiated licenses for the proprietary genes as well as the processes for inserting them into the rice of interest. It also facilitated national partners in seeking approvals from their governments for trials.

By 2014 researchers had developed 15 lines of "NUE", or "nitrogen-use efficient" rice that grow well in depleted soil – and extremely well in good soil. Another 19 varieties of NEWEST, which combine the three characteristics of nitrogen-use efficiency, water efficiency and saline tolerance, have also been developed. These have the potential to raise incomes and also bring abandoned cropland back to life.

The transgenic rice has been approved for confined field trials and is currently being tested in Ghana. Uganda and Nigeria will commence confined field trials in 2015.

NERICA 4 rice Transformed NERICA 4 (NEWEST rice)

What's next

Researchers will "introgress" the transgenic types with farmer-preferred varieties for each region after the best performing rice line is identified. The NEWEST rice will feature the taste, aroma, and growth traits that people like to plant and to eat, with just the special genes added.

Trials will still continue in the countries in addition to training programmes and drawing of agreements with seed companies to develop and make the new seeds available to farmers.

The estimated date for planting of NUE and NEWEST rice in farmer fields is around 2020.

An AATF Project Manager Speaks

"With the two rice projects – the Hybrid and NEWEST Rice – we expect to see rice yields increase considerably and imports decline as African rice agri-business picks up. As smallholders increase yields, they'll be producing more than they need for family use – so they can sell some to increase their income.

As we prepare for this transformation, it will be critical to continue working with the governments in public-private partnership arrangements that will support getting these products tested, approved, and marketed.

We will also work with other parties to create support networks to develop and produce the seeds needed and help with market access and related systems."



– Dr. Kayode Sanni, Project Manager for Rice, AATF

An AATF Project Partner Speaks

"Arcadia donated three key agronomic technologies: Nitrogen-use efficiency, wateruse efficiency, and salt tolerance, for use in the NEWEST rice project. We did that on a 'perpetual royalty-free' basis. Which means that no farmer in Africa will ever pay a fee for having these technologies in their improved rice.

"We believe that a royalty-free approach will facilitate rapid introduction of technology in Africa and get the most immediate results in terms of improved food security on the continent."



- Eric Rey, President and CEO, AATF partner Arcadia Biosciences, California, USA Farmers say they are willing to pay for a product that reduces the toxin in the field and beyond. AATF partners have developed such a product – aflasafe[™].

with fungus:

The Aflatoxin Control in Maize and Peanuts Project

aflasafe™

mpossible to identify without laboratory testing, aflatoxin is a potent poison and carcinogen produced by naturally occurring fungi, which are commonly found in soils in tropical and semi-tropical climates. Biocontrol methods largely take care of aflatoxin in the United States. Similar efforts led by IITA and USDA-ARS to address the aflatoxin menace are adapting the same method to African contexts, where aflatoxin is found in a large proportion of maize, peanuts, and even in the milk of grain-fed cows. The "aflasafe™ "biocontrol technology developed by the International Institute of Tropical Agriculture (IITA) and partners has been tested and it works. AATF was instrumental in facilitating the provisional registration in both Kenya and Nigeria. Aflasafe™ is now manufactured by IITA on a large scale in a factory in Ibadan, Nigeria for use by farmers.

Why we care

You can't see, smell, or taste it. But if you live in the tropics, you may well be swallowing a touch of aflatoxin along with your maize or peanuts.

Aflatoxin is a poison produced by naturally occurring fungi – mostly *Aspergillus flavus* and *A. parasiticus*. *Aspergillus* lives in soil and can infect maize, peanuts, chilli peppers and other crops throughout the tropics and sub-tropics. If crops are moist during harvest, storage, or processing, fungus and toxin levels can skyrocket.

While public awareness remains low, 25 percent of food crops around the world may contain the toxin, according to the UN Food and Agriculture Organization (FAO). Scientists estimate that 4.5 billion people – most humans on Earth – risk being exposed to the fungi.

Consuming large quantities of aflatoxin-laden food or brew at one time can be fatal – it will cause acute aflatoxicosis. Lower, chronic exposure can reduce immune function, damage multiple organs, and lead to liver cancer. It can also cause stunted growth in children.

Contaminated maize sickens animals, lowers milk and egg production – and leaves toxic residue in dairy and meat products, which then accumulates in people who consume these foods.

Aflatoxin dampens trade, too. The World Bank estimates that Africa loses over \$750 million in export revenue each year because of high aflatoxin levels in food. Both the European Union and the United States refuse to import products that fail to meet strict standards, measured in parts per billion. African countries have standards for aflatoxin contamination too, but they are rarely enforced.

To keep toxin levels low it also requires vigilance at many points in the value chain. For instance, minimising insect damage, drying grain rapidly upon harvest, and keeping it dry during transport and storage are all critical points. Without testing it's impossible for farmers or buyers to be sure about contamination levels without chemical analysis.

At the 2012 meeting in Mexico, G20 leaders announced that aflasafe[™] would be among the first pilot projects of 'AgResults' – an initiative designed to encourage use of agricultural technologies by the poor.

What we are doing

There is a reliable way to reduce aflatoxin levels right from the field. It's called "biocontrol." Initially developed by the U.S. Department of Agriculture (USDA), it has been used successfully and safely for two decades in the U.S.

How it works: Some strains of the *Aspergillus flavus* species do not produce the toxin. (They're "atoxigenic.") When broadcast on a farm, the atoxigenic strain outcompetes and displaces its toxic cousin.

There are many projects led by IITA that focus on developing, and applying the biocontrol solution for Africa. Other partners include the U.S. Department of Agriculture and AATF.

AATF and worldwide partners

- AATF has facilitated the process of registering the local fungus strains and aflasafe[™]
- IITA and USDA-ARS lead the technical activities in the development of Aflasafe including collection of samples, strains identification, laboratory facilities for testing of samples collected in Kenya, Nigeria and Senegal, and the provision of inoculum and other products required for trials and capacity enhancement
- Department of Plant Protection, Senegal sensitises farmers and conducts efficacy trials of aflasafe in the country
- Kenya Agricultural and Livestock Research Organization obtains approvals from the Kenyan regulatory agencies for the repatriation of Kenyan atoxigenic strains, conducts sensitisation and tests the efficacy of the Kenyan atoxigenic strains of *Aspergillus flavus*
- ACDI/VOCA in Kenya is responsible for training farmers on aflatoxin management
- The project is funded by the Bill & Melinda Gates Foundation and USAID through IITA and UK Aid from the UK government through AATF.

Success!

IITA has already developed a biocontrol agent based on local atoxigenic strains in Nigeria, Kenya, Senegal, and other countries. Called "aflasafe™," it has been tested and shown to reduce aflatoxin levels by up to 90 percent on the farm, with no ill effects on crops or people or the environment.

Farmers have shown interest and say they are ready to pay for a product that works. In addition, many consumers say they would pay a premium for foods they know are safer.

Aflasafe[™] will cost US\$ 1.50 per kg in Nigeria, with a recommended usage of 10 kg per hectare. Research shows that most Nigerian farmers could afford this much and pricing in other countries would be comparable. AATF is also looking into a sliding price scale, with possible government-subsidised rates for the poorest.

Aflasafe[™] has been fully registered and approved for commercial use in Nigeria. The Kenyan product aflasafe KE01[™] is provisionally registered in the name of KALRO for use in Kenya. IITA has built a production plant in Nigeria; in 2014 ground was broken for a similar but smaller modular facility in Kenya.

What's next?

Widespread control and testing of aflatoxin will benefit the health of consumers and the many farm families who eat what they produce. It could also lead to an economic boost from renewed exports of maize, peanuts, tree nuts, and other foods from Africa now banned on the international market.

Maize can look healthy yet still contain dangerous levels of aflatoxin. So can peanuts, tree nuts, chill peppers, cassava, dried fruit, and even milk from grain-fed animals.

WORLD-CLASS TECHNO

UB-SAHA

Cassava is the world's second most traded source of starch for industrial use but today, Asia supplies nearly all the exports. CAMAP aims to change that in favour of African growers.

Cashing in the second s

The Cassava Mechanisation and Agroprocessing Project



assava – also known as manioc, yuca and tapioca – is a starchy root crop from South America that crossed the ocean to become a major staple in Nigeria, Uganda, Zambia, and other parts of Africa. Famously resilient, cassava thrives in poor soils. But it is laborious to plant, weed, and uproot and some varieties can be toxic if not properly processed. Traditionally, women dry cassava in the sun and pound it with mortar and pestle before milling or selling it.

Currently grown mostly for subsistence in Africa, cassava holds huge promise as an industrial feedstock and could play a significant role in national industrial development if produced on a large scale.

Today AATF is leading a breakthrough in productivity through a value chain approach that includes mechanising production and agroprocessing of cassava. Yields in the field are almost triple the current African average of 7 to 9 tonnes per hectare.

Why we care

Africa produces more than half of the world's cassava, yet yields per hectare are lower than other continents, and nearly none is exported. Planting the cassava stems (it reproduces vegetatively), weeding, and digging up the roots take long hours and these activities are usually performed by women and children, impinging on schooling and other opportunities. Nevertheless millions of small-scale farmers rely on the crop for food and cash.

Nigeria sees a path out of poverty by developing both the supply and demand for cassava. As a start, the Federal Government of Nigeria created a policy requiring all commercially produced bread to include at least 20 percent cassava flour by 2017, and up to 40 percent thereafter. The government estimates that a 20 percent substitution will save the country over US\$ 700 million a year in foreign exchange – and transform cassava farming and processing into an industry that could employ well over a million people.

Increasing yields and mechanising production hold the key to a dynamic cassava sector that could bolster industrialisation in Sub-Saharan Africa.

What we are doing

AATF initiated the Cassava Mechanisation and Agroprocessing Project (CAMAP) in 2013 and conducted a global search for labour-saving machinery that was found in Brazil. There followed discussions and negotiations for access to the specially designed machinery for use in Africa. AATF has successfully imported tractor-drawn implements for planting stems, weeding around the shoots, and uprooting tubers for the project partner countries – Nigeria, Zambia and Uganda. Working with country partners, the project is demonstrating the various machines, generating tremendous excitement and interest among farmers both large- and small-scale.

The project is also linking these increasingly productive farmers to markets. Cassava starch is used in the manufacture of High Quality Cassava Flour (HQCF), sweeteners, paper, adhesives, plywood, textiles and tablet coating for drugs, among other products. Cassava chips and pellets are turned into animal feed, beer and industrial alcohol – with enormous potential for ethanol biofuel production.



Success!

So far, farmers have planted over 2,600 ha in Nigeria using the new equipment; and plans are underway to expand to 5,000 ha. Farmers participating in the project are harvesting 25-33 tonnes a hectare compared to 7-9 tonnes previously. Similar results have been reported in Zambia where farmers are harvesting an average of 24 tonnes per hectare up from 7 tonnes.

Farmers have realised tremendous time and labour savings. When planting manually, planting a hectare of cassava takes eight people two to three weeks. The machine accomplishes the same in less than an hour. This means less drudgery and more time for other activities, especially for overworked women and children.

As part of their contribution to the initiatve, farmers are giving back 60 percent of the stems they harvest to new cassava farmers joining the project. This will not only help to grow the initiative but it also contributes to the sustainability plan.

What's next

AATF plans to reach about a 1.5 million farmers in Sub-Saharan Africa. We are also helping local entrepreneurs manufacture and repair the equipment for planting, harvesting, and processing.

Of critical importance is to develop new markets swiftly – as production rises. So apart from mechanisation and boosting yields, AATF and partners are training entrepreneurs to develop new cassava products and cassava-based businesses.



Surrounded by part of her harvest, Funke Adiribigbe says she hopes her grand-daughter will join the latest generation of cassava farmers.

CAMAP Partnership

Mechanising a traditional crop and developing new products and markets takes wide collaboration.

AATF has negotiated agreements with Planti Centre Company in Brazil to demonstrate and possibly replicate their equipment. The project is also working with national and international agricultural research organisations, government ministries, NGOs, cooperatives, and private investors including the following:

- National Root Crops Research Institute, Nigeria
- National Centre for Agricultural Mechanisation (NCAM), Nigeria
- Kwara, Ogun, Kogi and Osun states, Nigeria
- Zambia Agricultural Research Institute (ZARI)
- National Crops Resources Research
 Institute (NaCRRI), Uganda

CAMAP activities are supported with funding from the United Kingdom Department for International Development (DFID). African cassava is processed mostly by hand. Much potential exists in mechanising processing as well as growing the crop.





As he strolls through cassava plants that are taller than him, one farmer and local leader says:

"This is just five months old – and no one can believe it. This is the AATF magic. They want us to succeed, and we have started success already. If you look around, you will know that AATF is doing something wonderful for us."

> – HRH Oba Emmanuel Onolapo Oyileso, Osun State, Nigeria.

On a recent site visit, the visitors were overwhelmed with hospitality, gifts and invitations.

One farmer and grandmother summed up the many effusive comments: "This is a wonderful programme!" said Funke Aderibigbe.

Funke retired as a teacher and school administrator, then turned to farming full-time. But challenges of labour and marketing made her nearly give it up. Today she grows cassava – and only cassava – because "AATF has made cassava planting easy". She's urging her unemployed daughter and son-in-law, as well as anyone else who asks, to enter the business.

"Cassava planting is no more a small business. It's now a big business. You can use it to build a house, buy a car, invest in more land, help your family and others," says Aderibigbe. Biotechnology holds tremendous potential for raising food security and income throughout Africa

hiornation for progress:

The Open Forum on Agricultural Biotechnology in Africa (OFAB)



illions of farmers in more than 28 countries worldwide plant crops improved through modern biotechnology. This is because biotech crops solve specific problems of interest and increase productivity. Adoption of genetically modified crops (GMOs) has grown more than 100-fold in less than two decades. In Africa however, only three countries, South Africa, Burkina Faso and Sudan, have so far commercialised GMOs. Majority of African countries are yet to fully embrace use of biotechnology in agriculture as debates continue to focus mainly on hypothetical risks and concerns related to value, safety and impact (agronomic, economic and environmental). Numerous credible and independent studies have shown that products of biotechnology are as safe as their conventional counterparts but most policy makers on the continent often find themselves confronted with contradictory sources of information on biotechnology as scientific facts are often mixed with social, ethical and political considerations. In the face of a rapidly growing population, declining agricultural productivity and reduced resources available for agricultural research, African policy makers are under pressure to look for alternative solutions to the challenges of food security. Biotechnology has been identified as one of the options for dealing with agricultural productivity challenges in Africa. Even so, given the controversies surrounding its use, policy makers need good guidance to be able to make informed decisions. AATF therefore set up the Open Forum on Agricultural Biotechnology in Africa (OFAB) to provide a platform that facilitates the flow of factual information from the scientific community to policy makers and the public for rational decision making.

Why we care

Biotechnology holds tremendous potential for raising food security and income throughout Africa. Biotech crops can thrive in severe conditions such as drought or salinity; resist damaging insect pests and diseases; and dramatically reduce time spent on weeding and other chores thereby freeing valuable time for the farmer to attend to other productive economic activities.

While extensive trials have proven a number of biotech crops safe and effective in Africa, few are currently available to African farmers due to a multiple of factors, including absence of science-based regulatory systems to facilitate commercialisation of biotechnology products in most African countries.

The bottleneck

Biotechnology has been poorly understood and remains controversial in many countries, turning it into a political hot potato for most policy makers in Africa. GMOs in particular have attracted conspiracy theories and misinformation campaigns.

Misinformation has had quite a negative impact on policy decisions contributing to lack of evidence-based policies that can facilitate safe development and diffusion of biotech products.

What we are doing

AATF founded OFAB in 2006 with the aim of encouraging open discussion of issues that hinder understanding and informed decision making on development and use of agricultural biotechnology.

From one chapter in Kenya, today OFAB is active in eight countries, working with governmental institutions to support biotechnology advocacy, communication and knowledge sharing aimed at creating an enabling environment for acceptance and uptake of agricultural biotechnology products.

OFAB partners are actively engaging governments and citizens to discuss both benefits and challenges of biotechnology through various platforms that encourage a regular flow of factual information from the scientific community to policy makers, media and the public. OFAB stakeholders include journalists, farmers, scientists, regulators, industry, legislators and policy-makers among others.

The engagement platforms utilised by OFAB include monthly meetings, community meetings, traditional mass and social media, study tours, exhibitions, trainings, conferences and information materials.

To be effective, OFAB encourages networking with likeminded institutions and individuals at the regional and global levels.

OFAB Partnership

AATF provides overall coordination of OFAB. Partners include:

- Institut de l'Environnement et de Recherches Agricoles, Burkina Faso
- Ethiopian Institute for Agricultural Research, Ethiopia
- Council for Scientific and Industrial Research, Ghana
- International Service for the Acquisition of Agri-biotech Applications, Kenya
- National Biotechnology Development Agency of Nigeria, Nigeria
- Tanzania Commission for Science and Technology, Tanzania
- Uganda National Council of Science and Technology, Uganda
- National Biotechnology Authority, Zimbabwe

The project is partly funded by the Bill & Melinda Gates Foundation. Initial funding to support project design and implementation came from the Rockefeller Foundation, the United Kingdom Department for International Development (DFID) and the United States Agency for International Development (USAID). The project has also received funding from NABDA, PBS and AfricaBio for specific country chapter activities in Nigeria, Uganda, Kenya and Zimbabwe.

Success

From its first chapter in 2006, OFAB has grown to eight chapters hosted by various government departments.

During its eight years, OFAB has witnessed an increase in media coverage of biotech stories in both main stream and other media, not to mention movement from mostly negative to more favorable and neutral stories.

There has been a larger number of local scientists speaking for biotech and explaining the science behind it in lay man's language, thanks to outreach and training through OFAB and other partners.

On the policy front, there has also been increased interest by policy makers in biotechnology, especially in understanding it thereby calling for greater awareness and education. Some countries have moved to pass good laws and regulations to facilitate research and deployment of products.

An AATF Officer Speaks



For better or for worse, the world of today is mass and social media mediated. That is why we in OFAB are happy to see positive changes in the way journalists in Sub-Saharan Africa are covering biotech issues compared to a decade ago when negative stories based on myths and unfounded concerns dominated.

Comparatively, today biotech reporters mostly rely on local sources and experts for information they need to write a relevant biotech story. Most science journalists have also become more conscious of the need to verify information so that they can separate facts from myths, thanks to increased access to credible sources of information on biotechnology as a result of deliberate efforts by OFAB and other stakeholders to bridge the trust-related gap between scientists and journalists through various means.

Consequently, there has been marked increase in accurate, objective and responsible reporting on issues surrounding agricultural biotechnology and biosafety, especially in OFAB countries of Burkina Faso, Ethiopia, Ghana, Kenya, Nigeria, Tanzania, Uganda and Zimbabwe, and indeed other African countries.

With that kind of healthy information exchange, prospects for upward trends in acceptance and adoption of biotechnology by more countries in the region are beginning to manifest. And if that continues over time, the biotechnology narrative in SSA is likely to change from being focused on risks, safety and other ungrounded concerns to a more positive tone of how the continent can responsibly harness the enormous potentials of the technology in order to improve its dwindling agricultural productivity and declining food security situation.



That is the vision that OFAB is relentlessly pursuing!

Too few African farmers have reliable access to quality commercially produced seed; even fewer, to new innovative seed based technologies developed by crop breeding programmes around the continent and the world.

C right seeds at the right time, place, and price:

The Seeds2B Project



ithout good seeds, crop yields as well as the quality of farm produce will be compromised and this will disappoint farmers no matter how hard they work. Timely availability of affordable, quality seed of better-performing and locally adapted varieties is one of the greatest constraints facing the advancement of smallholder agriculture in Sub-Saharan Africa (SSA). Thanks to a new partnership between AATF and the Syngenta Foundation for Sustainable Agriculture (SFSA), smallholders will soon be able to access improved seeds and grow more and better crops. AATF operates as a broker between African and international breeders who develop improved crop varieties and local commercial seed producers and distributors who have the capacity to deliver quality certified seed of high performing, preferred crop varieties to a large number of farmers in time for planting.

Why we care

One reason that African agriculture has not kept pace with world agricultural performance is that only a few farmers have timely access to clean, healthy, high-quality seeds.

The majority of smallholders rely on replanting what they harvest which usually results in low yields and, at times, planting diseased material. These farmers miss out on new breeding developments and as a result, crop yields and farm income remain far below their potential.

Good seeds exist in African research centres and elsewhere. But they often do not reach the farmers who need them, even when they can afford the seeds. What is needed is a



Many farmers "recycle" seeds from their last year's crop, with little quality control, leading to poor harvests.

reliable bridge – a broker – between breeders who develop improved crop varieties and local seed enterprises who sell seed to farmers.



AATF and SFSA have developed a unique business model: negotiating with breeders for access to locally appropriate varieties towards facilitating farmer access to affordable, quality seed of better performing varieties through competent local seed enterprises.

The Seeds2B Partnership

- AATF identifies locally appropriate seed based technologies and negotiates for access on behalf of local seed enterprises. It ensure that the breeders get a fair return on their investment in crop improvement, and local seed producers and distributors gain access to marketable varieties.
 AATF also works with seed enterprises to improve seed delivery channels so that farmers can make the best use of the improved seeds
- National research programs, NGO's and other private partners conduct trials for introduced varieties and demonstrate new technologies to farmers
- Local seed producers and distributors produce and market the new seeds

Project activities are supported with funding from the Syngenta Foundation for Sustainable Agriculture.

What we are doing

The Seeds2B Project is designed to facilitate smallholder access to locally appropriate, high performing crop varieties through local seed enterprises, especially when crop varieties are patented.

Through the Project, AATF acts as a seed technology broker; helping national agricultural research systems and private breeders transfer crop varieties proven to be betterperforming, adaptable and market appropriate to local seed producers and distributors in return for fair returns.

With the partnership's facilitation, quality, affordable seed of high performing and locally preferred varieties will get to the hands of farmers enabling them to serve their markets with the best of locally grown produce.

Success in progress

The Project has accessed some best bet varieties that are being tried in Zimbabwe and Malawi – other countries are in the pipeline.

What's next

AATF is in the process of identifying a wide array of improved seeds that could dramatically raise yields and income for smallholders. This includes seeds for staples such as sorghum, millet, and potato; plus high-value cash crops like tomatoes.



Special project

The Africa Biofortified Sorghum (ABS) Project

orghum is one of the important staple crops cultivated in arid and semi-arid regions of Sub-Saharan Africa. The African Bio-fortified Sorghum (ABS) project aims at developing sorghum varieties enriched with amino acids methionine and lysine, vitamins A, E and D, and the micronutrients iron and zinc.

The project is led by the Africa Harvest Biotechnology Foundation International and involves a consortium of partners including: AATF, University of Pretoria in South Africa, University of California, Berkeley, USA, Pioneer/ DuPont, Council of Scientific and Industrial Research in South Africa, Agriculture Research Council in South Africa, International Crops Research Institute for the Semi-Arid Tropics, the Kenya Agricultural and Livestock Research Organization (KALRO), the Institute of Agricultural Research (IAR) and the West African Council for Agricultural Research and Development.

AATF's primary role in this project was the management of intellectual property where it coordinated the conduct of technology inventories and freedom to operate (FTO) assessments, formulated best management practices in intellectual property for inclusion in the ABS policy manual, and provided licensing advisory services to members of the consortium.

For more information please visit http://biosorghum.org/



Special project

Commercial Products II (COMPRO II) **Project**

uring the past decade, new bio-fertilisers, bio-pesticides and chemical agro-inputs have been commercialised, but many of these products are often insufficiently evaluated for quality and efficacy due to inadequate national and regional regulatory systems. As a result, African farmers are inundated by a plethora of products that promise miraculous yields yet for guite a number their efficacy and effectiveness remain unproven. Often, agro-input dealers misuse environmental arguments for organic, low input farming to promote such products to the unsuspecting and vulnerable farmers. There is therefore an urgent need for supporting emergence of a policy environment that can guarantee guality control procedures on such products to provide farmers with incentive to invest in new agricultural technologies.

To ensure effectiveness, safety and quality assurance of the bio-based products on the market, the Commercial Products project (COMPRO II project) was launched in 2012 for implementation in six Sub-Saharan African countries namely Kenya, Uganda, Tanzania, Ethiopia, Ghana and Nigeria. Led by the International Institute for Tropical Agriculture (IITA), the COMPRO II initiative works towards creating an enabling policy atmosphere for testing, registration and dissemination of promising candidate bio-fertilisers, bio-pesticides and chemical agro-inputs to increase crop yields.

Based on long-standing experience in regulatory affairs including compliance management for development of agricultural products, AATF was tasked with facilitation of establishment and institutionalisation of quality control and regulatory mechanisms for bio-fertilisers and biopesticides in the six project countries. This would involve engaging regulators and policy makers through dialogue and capacity enhancement efforts to catalyse emergence of a conducive regulatory environment for testing and registration of bio-fertilisers and bio-pesticides in Sub-Saharan Africa.

What we are doing

AATF is providing guidance in the development of regulatory instruments, building necessary capacities and assisting in clarification of institutional roles for effective enforcement and quality control.

Success

Since policy formulation and implementation is the primary business of government agencies, AATF has sought and entered MoUs with national regulatory authorities in COMPRO II project countries to steward policy and regulatory processes pertaining to testing and registration of bio-fertilisers and bio-pesticides. Several consultative workshops have been held and consensus built around modalities for developing and implementing registration guidelines, Standard Operating Procedures (SOPs) for testing, registration, labelling and quality standards for bio-fertilisers and bio-pesticides, as well as development of manuals for bio-fertiliser inspectors. These instruments have been subjected to stakeholder review and input and are at different stages of validation, approval and adoption for routine use in the target countries. The project has also prepared and disseminated policy briefs to guide policy formulation and implementation of bio-fertilisers and biopesticides in SSA.

What's next

Finalisation and adoption of SOPs for testing, registration, labelling and quality standards for bio-fertilisers and bio-pesticides in Kenya, Ghana and Tanzania.

Continue enhancing capacities of bio-fertiliser inspectors through training for effective market place surveillance and enforcement of the regulations for quality control.

The project will continue engaging policy makers and other actors through policy briefs to create a conducive environment for testing, registration and commercialisation of products.



Participants to the Biofertiliser Inspectors Training, held in Tanzania in June 2015

Special project

Forum on China-Africa Co-operation (FOCAC)

n 2008, in preparation of the fourth Forum on China-Africa Co-operation (FOCAC) meeting, AATF was commissioned by the Rockefeller Foundation to conduct a study on the relevance of Chinese agricultural technologies in smallholder farming systems in Sub-Saharan Africa (SSA). FOCAC is the main mechanism for structured dialogue between China and Africa, and the 2009 forum offered an opportunity for catalysing new thinking on Chinese-African engagement which was anchored on agricultural development.

What we did

The study began with an assessment of farmer constraints in nine countries: Kenya, Ethiopia, Tanzania, Ghana, Burkina Faso, Nigeria, Malawi, Mozambique and Zambia. Key constraints identified included poor soils, drought, limited access to improved varieties, lack of irrigation facilities, poor water harvesting and management, high pest and disease incidences, low mechanisation, poor research and extension, and ineffective agriculture policies.

A number of Chinese agricultural technologies that would match the needs of SSA farmers were identified and catalogued. These included marker-assisted breeding and recombitant gene technologies, germplasm improvement through conventional breeding and molecular techniques, pest and disease control, mechanisation, weather forecasting and information technology systems.

The study recommended a strategy for the adoption of these technologies for the benefit of Africa's smallholder farmers and proposed that the China–Africa Development Fund (CADFund) be used for investment projects in agriculture. The report also commented on the critical need to develop the market infrastructure if Africa's agriculture was to move beyond subsistence.

The project helped to prioritise agriculture in the China-Africa economic and technological cooperation as it opened a new frontier for dialogue between China and Africa based on a fully informed agriculture priority setting for the respective countries. It was disseminated during the FOCAC meeting held in Cairo from 6 to 8 November 2009 and several follow up conferences and meetings in the respective countries. It is expected to increase awareness among African decision-makers of new areas where China could make contributions to Africa's agricultural development.



AATF project countries





AATF is about African farmers and linking them with practical, technological solutions. Use of appropriate technology is key to reversing the low agricultural productivity in Africa and unlocking the potential of African smallholders. These technologies vary depending on the priority needs identified by farmers and can include chemical, mechanical, biological, biotechnological and process-based solutions.

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