AATF

PROSPERITY THROUGH TECHNOLOGY

Stories from Farmers

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Foreword

Fifteen years ago, we set out on a mission to give small-scale African farmers a chance for ***better lives*** by ensuring they got ***better harvests*** through giving them access to ***better*** agricultural ***tools*** and knowledge.

This collection of stories was written to allow various farmers to give testimony to how our work, supported by various partners and collaborators, is making their lives better.

It is a compilation that captures achievements as experienced every day by men and women farmers, and their interaction with the gradual, transformative agricultural initiatives.

We are delighted to share with you these stories believing the voices will serve to justify the trust that our partners and investors have placed in us.

Thank you once again for your most generous and committed support and partnership.

Dr Denis T. Kyetere
Executive Director, AATF

Mitigating the impact of climate change on agriculture

Climate change is one of the most disruptive influences on agriculture with significant impacts on food systems. The recurrence or persistence of drought and high temperatures continues to devastate agriculture especially in Africa where success of the production system is sensitive to climate variability.

The brunt of the climate-change related pain is mostly borne by people living in Sub-Saharan Africa because the continent's economy and growth is highly dependent on rain-fed agriculture. It is estimated that between 75 and 250 million people in Africa may be exposed to increased water stress due to climate change by 2020, with yield decreasing by up to 50%. Therefore, threats associated with climate change undermine global food security and puts aspirations such as the United Nations Sustainable Development Goal of ending poverty in all its forms in serious jeopardy.

Africa, the most vulnerable continent where agriculture is dominated by small-scale farmers, will need to essentially embrace resilient production systems that support climate-smart agriculture. It is important therefore that the continent develops climate smart crops that can provide high yields even in drought conditions. The development and use of drought tolerant seed varieties among other interventions is an effective approach to addressing this challenge.

AATF has thus taken initiative towards improving resilience of key staples through the development of drought tolerant maize and rice with good water use efficiency. If nothing is done, yields of rainfed maize, for example, are projected to decline by as much as 25 percent or more by 2050.

Surviving the effects of drought stress through DroughtTEGO® maize

Boaz Nyateng (left), a farmer and chairman of Lambwe Seed Growers Association in Homabay, Western Kenya, with a WEMA Project enumerator at his farm. PHOTO/AATF

Members of Lambwe Seed Growers Association (LASGA) have mixed memories about the year 2016. Some say it is the year they learned not to fear to venture into new technologies, while a few would rather forget quickly that year, when prolonged hunger visited their land.

Boaz Nyateng is one of the few who is still grateful for the day, two years earlier, that he decided to attend a field training organised by the AATF, to introduce a new variety of drought-tolerant maize seed.

'The field officers trained us on the good farming practices including how to space the seed, fertiliser application, farm management and post-harvest handling of grain. They also linked us to Ultravetis, a seed company which supplies our input store with the certified seeds enabling farmers to access the seeds easily,' remembers Boaz.

It was during that training in 2014 that Boaz learnt about DroughtTEGO®, a hybrid maize seed. That training and performance of the demonstration field changed his perception and he has been growing DroughtTEGO® ever since.

DroughtTEGO® is one of the products from the Water Efficient Maize in Africa (WEMA) Project, a public-private partnership initiative coordinated by AATF and funded by the Bill & Melinda Gates Foundation, that has been working to help farmers access maize varieties that can withstand frequent drought and insect-pest damage.

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Boaz Nyateng

Through WEMA, 106 new maize seed varieties have been released in 5 years, 101 being DroughtTEGO® and 5 TELA. The project used a combination of conventional, marker-assisted breeding and advanced biotechnology techniques to develop drought tolerant and insect resistant maize varieties in response to the climate change threat.

DroughtTEGO® is one of the conventional varieties that is already helping farmers develop resilience in the face of climate change and is boosting the commercial seed market in the region.

Boaz says that during the 2016 drought, he still managed to harvest 9 bags of 90 kg each from his one-acre farm, when most of those who planted other maize seed varieties harvested as little as 1.5 bags from similar land size.

The adoption and cultivation of WEMA products are expected to benefit at least 12 million people with a projected yield increase with an estimated value at over USD280 million by 2025.

'Since my experience in 2016 when my family for the first time had enough food and even some extra bags to sell, I have never stopped encouraging members of my group to take up DroughtTEGO®,' says Boaz.

Saved from crop failure and costly maize meal

Jane Sabula, a DroughtTEGO® farmer, at her farm in Eliang'oma village, Luanda Sub County, Vihiga County. PHOTO/AATF

In Vihiga, as in the rest of Kenya's Western region, maize is by far the staple food crop. In 2017, both long and short rain seasons brought far less rain than usual, resulting in depressed maize harvests.

As stocks of maize grain fell, the price of maize flour rose by almost double from Ksh90 for a 2kg packet of maize flour to Ksh150, an increase that Jane Sabula is grateful that she did not suffer.

Looking at the failed crops around her neighbours' farms in Eliang'oma village in Vihiga County, 50-year-old Jane Sabula is grateful for the decision she took in 2015 to start planting DroughtTEGO® hybrid maize on her farm.

At her local church, most of the stories from her fellow women are about crop failure, and the difficult choices their families have to make between buying maize flour and sending their children to school.

'I am not sure if it's this soil that has favoured your seed over other maize varieties, because there is no time I ever harvested more than two bags (a bag is 90-kg) of maize from my one-acre farm. I thank God that as soon as I planted your maize seed I have not suffered hunger, even when my neighbours complained of maize shortage,' she says.

Jane first heard about the maize seed at a seminar held by a local non-governmental organisation in 2015. She was sceptical at first given that she had previously tried several other hybrid seeds, but with little improvement in her yield.

After visiting a couple of DroughtTEGO® demonstration fields, she decided to give it a chance, which was the beginning of good tidings for her.

'I am not sure if it's this soil that has favoured your seed over other maize varieties, because there is no time I ever harvested more than two bags (a bag is 90-kg) of maize from my one-acre farm. I thank God that as soon as I planted your maize seed I have not suffered hunger, even when my neighbours complained of maize shortage,'
Jane Sabula

Jane's experience is one that many farmers go through in a search for seed that fits their needs. She attributes the poor results she got previously to low knowledge of how to choose maize seed. 'I would walk into an agro-dealer shop with no particular hybrid in mind, but the performance of the hybrids would depend on pure luck, you would either succeed or fail,' she says.

With her first DroughtTEGO® planting in 2015, life changed for Jane. 'When I planted TEGO® for the first time, I got 8 bags of maize from the same piece of land which I had toiled on for years,' Jane says with a beaming face. She is now able to save money for other uses.

In areas such as Eliang'oma village in Vihiga County, farmers like Jane are now encouraging their neighbours to plant TEGO® as one way to raise productivity of their farms towards better food security.

Giving hope a chance: Farmer stories on the DroughtTEGO® hybrid

Dr Murenga Mwimali (left), the WEMA Country Coordinator from KALRO, discusses WEMA hybrids with Dr Pindi Chana from the Tanzanian High Commission in Nairobi and Caleb Obunyali from AATF at the CIMMYT research station in Kiboko

Patrick Magana, a farmer in Kisumu County, reckons he made a good choice when he adopted the DroughtTEGO® hybrid. He has been farming for more than 20 years, and he initially used the short-term varieties due to weather changes. He practices due diligence before adopting new technology because agriculture is his main source of income.

'I follow up on new seeds so that I can plant the latest technologies as our area here is so dry and usually we don't get good harvests if we don't go for good seeds,' he says.

With TEGO®, Patrick has harvested 370kg of grain on his 0.4 acre of land, where he would previously harvest 210kg.

'We have received up to 16 lines of maize which we don't usually get with other varieties.'

Due to his experience in farming, Patrick is a model farmer in his region. 'Farmers look up to me; now we have a lot of demand for TEGO® because they want to get the same harvest I had,' he says.

According to Patrick, the more farmers adopt the DroughtTEGO® hybrid, the better chances of food security. Depending on weather patterns has sometimes proved to be costly, he adds.

Meanwhile in Vihiga County, Gladys Avedi has just harvested the DroughtTEGO® hybrid from a 100-meter

'I follow up on new seeds so that I can plant the latest technologies as our area here is so dry and usually we don't get good harvests if we don't go for good seeds.'
Patrick Magana

square piece of land. She had spread several ears on the ground to dry before shelling. She said the white colour of the grains was attractive.

Gladys' neighbours were curious about this new hybrid, and a number of them bought the seeds during field days set up to showcase the hybrid's performance.

Gladys says she is motivated to continue planting the DroughtTEGO® because where she would originally harvest about 20kg of grain she harvested 80kg.

Armed with her 2kg packet of the seed for next season's planting, Gladys is hopeful about her future as a farmer.

'This is good seed and I think if I plant a lot of it, like one acre, I can sell some of the produce when I harvest, pay school fees for my children as well as have enough to feed my family,' she said.

This is good seed and I think if I plant a lot of it, like one acre, I can sell some of the produce when I harvest, pay school fees for my children as well as have enough to feed my family'
Gladys Avedi

A field officer explains to high school students the virtues of DroughTEGO® maize hybrids during a field day in Western Kenya

Enabling initiatives

Making a meaningful difference in the lives of smallholder farmers requires a supportive and enabling environment that will stimulate innovation, technology uptake and agribusiness. Countries that create conducive business climates employ sound policies, institutions and services to promote investment, attract capital and engender economic growth. Because agriculture has a direct link to food security, it is generally regarded as strategically important for countries in the developing world.

AATF was principally established to address some of the obstacles to agricultural technology access and delivery across the food value chain from research, production, processing through to market linkages. This was born of the belief that science and technology can positively impact agricultural development, but only if the technologies get into the hands of farmers in a systematic and sustainable way.

AATF, therefore, collaborates with various public and private sector partners across Sub-Saharan Africa (SSA) to address obstacles to smooth flow of agricultural technologies from developers to end users. This includes advocating for better policy environments, functional institutional arrangements and political support for agricultural innovations.

To contribute effectively towards attaining the desired enabling environment, AATF has mainstreamed into its research and development projects complementary enabling functions that include intellectual property rights, policy advocacy, regulatory support, technology stewardship, communications and issue management, product deployment, and seed systems.

Kenyan farmers form a grassroots organisation in support of biotech crops

The officials of the Kenya National Society for Biotechnology Farming: (left to right) Mugo Magondu (Chairman), Titus Ndalamia (Vice-Chairman), Jackson Omwoyo (representing South Rift farmers), James Riaga (representing Nyanza region farmers), Michael Kasena (Secretary), Abisage Auma (Treasurer), Nahason Ong'ale (representing Western Kenya), Naomi Kamau (representing Eastern Kenya), Damaris Tarus (representing North Rift farmers)

Naomi Kamau, a farmer from Eastern Kenya trying like other smallholder farmers to get the most out of her farm, used to be apprehensive about adopting new farming technologies.

'Although I believed modern technologies can help me improve, I felt I would rather continue with my modest harvest than risk getting nothing at all while trying out new things,' she says.

Several visits to demonstration farms in Western Kenya and a series of sensitisation meetings organised by the Open Forum on Agricultural Biotechnology in Africa (OFAB) have however helped Naomi gain courage and she is now keen to have new technologies, including genetic engineering, made accessible to farmers around the country.

The information interface between scientists, policy makers and the public has not been strong enough to support understanding and decision making on biotechnology, a gap that AATF sought to plug with the establishment of OFAB. The Forum brings together stakeholders in agriculture and enables interactions between scientists, journalists, the civil society, industrialists, lawmakers and policy makers. The Forum provides an opportunity for key stakeholders to share knowledge and explore new avenues of bringing the benefits of biotechnology to Africa. It has been promoting better understanding of a range of biotech products, the benefits and concerns

associated with biotechnology, and providing opportunity for policy makers and the public gain access to the pool of knowledge held by scientists.

For an enabling environment to be realized people like Naomi whose livelihoods depend on agriculture will need to get involved. Naomi is now one of the officials of a farmers' organisation that aims to push for policy changes to facilitate growing and commercialisation of GM crops – the Kenya National Society for Biotechnology Farming, an outcome of OFAB-Kenya's initiative to create awareness among farming communities.

'We are keen about creating agricultural biotechnology awareness among farmers so they can make their decisions from a point of knowledge,' says Daniel Otunge, OFAB Project Manager.

The farmers have already elected an inaugural steering committee and have also contributed funds towards set up of the organisation.

The farmers are confident that such groupings will facilitate quicker channeling to farmers of beneficial technologies introduced in the country and provide stronger representation when advocating for farmers' interests.

We are keen about creating agricultural biotechnology awareness among farmers so they can make their decisions from a point of knowledge,'
Daniel Otunge

Maize Lethal Necrosis (MLN) diagnosis training prevents losses for seed companies

National Performance Trial committee members from Kenya Plant Health Inspectorate Service during a field visit at the WEMA MLN trial site in Naivasha on 22 November 2016. PHOTO/CIMMYT.

The financial year 2015/2016 still sticks in the mind of Eric Tegei, the Quality Assurance Manager at Kenya Seed Company.

'That year we lost over US$100,000 from 35 lots of maize seed that had been affected by the Maize Chlorotic Mottle Virus (MCMV),' he says.

The virus, in combination with the Sugarcane Mosaic Virus (SCMV), is responsible for Maize Lethal Necrosis (MLN) disease, first reported in Kenya in 2011 and which for several years wreaked havoc on maize production in East Africa. The disease results in yield losses of up to 100%, thus raising food insecurity and affecting grain trade.

One of the biggest challenges in management of the disease used to be lack of diagnostic kits and absence of a harmonised approach for producing seed free from MCMV.

The Maize Lethal Necrosis (MLN) Diagnostic and Management Project has been working in eastern Africa towards containing and preventing the spread of the disease to non-endemic countries in Sub-Saharan Africa by supporting the production of MCMV-free commercial seed and promoting the use of clean hybrid seed by the farmers.

AATF 's role is to support production of MCMV-free seed in Kenya, Rwanda, Tanzania, Ethiopia and Uganda. With the trans-boundary nature of infection,

it is crucial that countries adhere to a common management approach, including quality control in production of seeds.

Until early 2016 – five years after the invasion of MLN in East Africa – most seed companies did not have a specific formula for control or a documented management approach for the disease.

In the first year of invasion, control of MLN was based on knowledge of seed production staff, which the companies relied on to make decisions on the situation.

'Since the industry does not get systematic and standardised scientific steps and operating procedures, decisions on control and management of MLN tended to be subjective and risk-prone,' remembers Eric.

Eric was one of the beneficiaries of an initiative by AATF and the International Maize and Wheat Improvement Centre (CIMMYT) (supported by the United States Agency for International Development (USAID)), which saw seed companies and out-growers in Kenya, Tanzania, Rwanda, Ethiopia and Uganda being trained on use of diagnostic kits and harmonised standard operating procedures for MCMV-free seed production.

'I remember how lack of experienced personnel, knowledge on the disease and unavailability of MLN diagnostic tools resulted to losses, throwing the industry into panic. When the government introduced PCR testing at the Kenya Plant Health Inspectorate Service (KEPHIS), it meant that the cost of seed certification rose by over 13 per cent,' says Eric.

Seed companies incurred losses from samples confirmed positive in the lab since it could not be sold to farmers as seed.

Even with the availability of rapid field diagnostic testing kits, there was still need to standardise procedures and decisions on MLN control and management, a situation AATF helped to solve by harmonising the procedures and conducting trainings on MLN control checklist.

'The crop diseases can be dynamic given changing climatic patterns globally. We are grateful for partnering with organisations like AATF because we can get assistance whenever current tools become ineffective,' says Eric.

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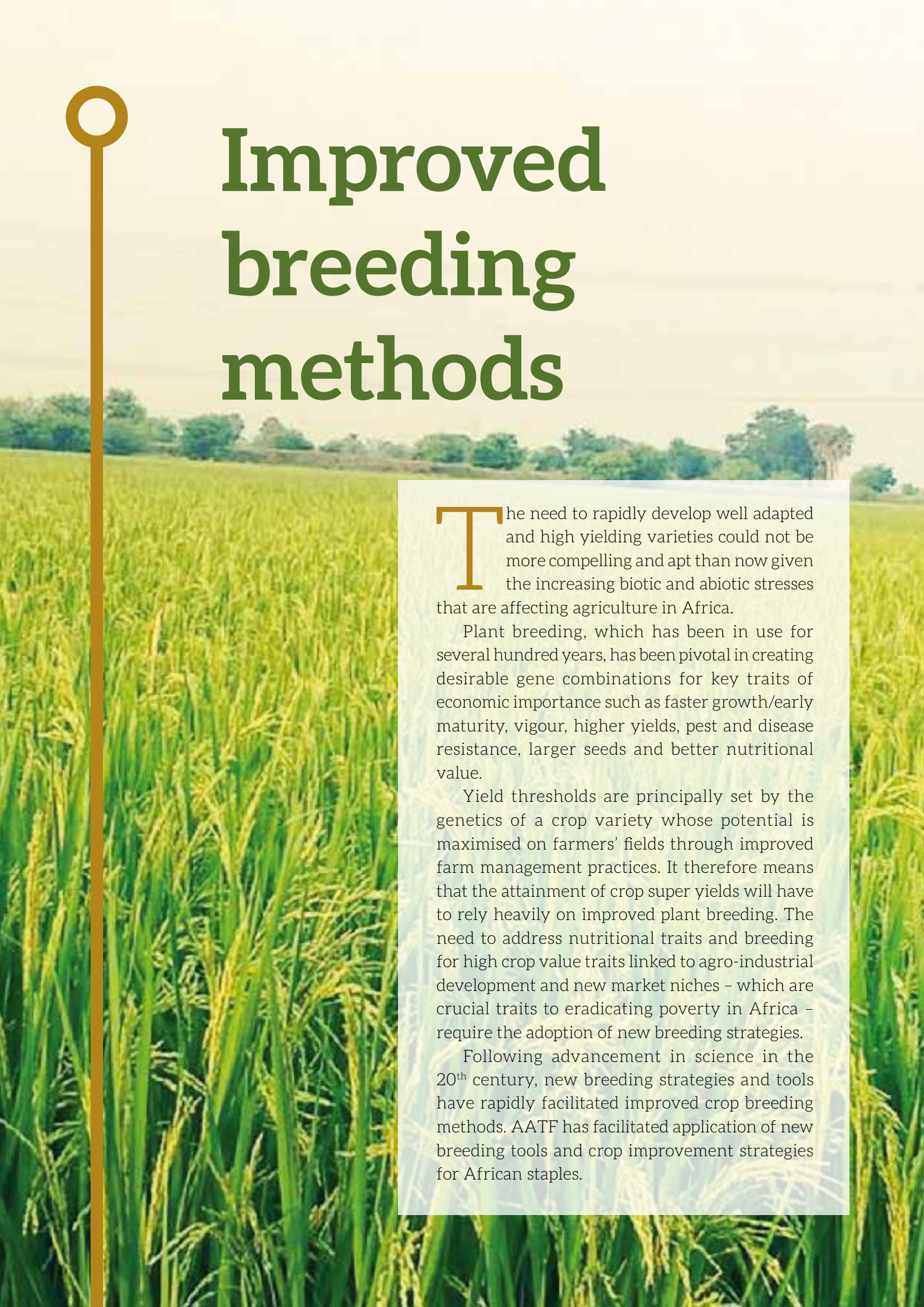
Improved breeding methods



The need to rapidly develop well adapted and high yielding varieties could not be more compelling and apt than now given the increasing biotic and abiotic stresses that are affecting agriculture in Africa.

Plant breeding, which has been in use for several hundred years, has been pivotal in creating desirable gene combinations for key traits of economic importance such as faster growth/early maturity, vigour, higher yields, pest and disease resistance, larger seeds and better nutritional value.

Yield thresholds are principally set by the genetics of a crop variety whose potential is maximised on farmers' fields through improved farm management practices. It therefore means that the attainment of crop super yields will have to rely heavily on improved plant breeding. The need to address nutritional traits and breeding for high crop value traits linked to agro-industrial development and new market niches – which are crucial traits to eradicating poverty in Africa – require the adoption of new breeding strategies.

Following advancement in science in the 20th century, new breeding strategies and tools have rapidly facilitated improved crop breeding methods. AATF has facilitated application of new breeding tools and crop improvement strategies for African staples.

New varieties of hybrid rice promise better yields

Naftali Okemwa, a rice breeder, working in the hybrid rice seed production facility in Malindi, Kenya

Dr Kayode Sanni, the AATF Hybrid Rice Project Manager, can start dreaming about the pomp and ceremony that will very likely accompany the launch of Kenya's first indigenous rice hybrid.

It will be a well-deserved celebration, considering the agony of rice farmers who have had to contend with multiple challenges including losses to pests, poor rating of local varieties in the international market and low yields.

'In May 2017, we inched closer to delivering the first indigenous rice hybrids in Kenya after the second national performance trials showed the new varieties had the desired traits of early maturity, higher yields and disease resistance,' says Dr Sanni.

Through the Hybrid Rice Project funded by the Bill and Melinda Gates Foundation, AATF has been working with partners to develop hybrid rice with significant yield advantage using the 2-line rice hybrid system technology. The project is working with private companies and public institutions in Kenya and Tanzania to ensure the technology reaches farmers and increases their rice yields and, thereby, income streams.

In Kenya's second national performance trials completed in 2017, results showed potential for up to three times increase in production per hectare, with fewer cases of diseases reported. Once commercialised, the varieties could reduce the country's import requirements.

In 2018 alone, Kenya imported about 750,000 tonnes of rice, as rice consumption gradually grows in a country with a rising middle class.

'The new varieties yield between 7 and 10 tonnes per hectare compared with the current 3 tonnes per hectare for local varieties. The hybrid rice we have produced is as competitive as imported hybrid rice seed in terms of quality and affordability,' said Dr Sanni, adding that commercial seed companies in Kenya and Tanzania have shown considerable interest in taking up these hybrid rice products.

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Dr Kayode Sanni

Promoting mechanisation for efficiency in production

Transformation of African agriculture from subsistence farming under low implement use to modern/commercial farming under best bet production practices powered by use of advanced tools or machinery is critical to improving farmer livelihoods and economic growth in Sub-Saharan Africa. It is increasingly clear that African farmers will need to apply appropriate tools and machines because mechanisation can increase production efficiency, timeliness of operations and facilitate increased output of higher value products at a lower cost of operations and better profit margins from product sales while eliminating the drudgery associated with human muscle-powered cropping.

Apart from obvious advantages which mechanisation offers such as the potential to expand the area under cultivation and timely completion of critical farming operations and, in many cases, the quality

of work leading to increased crop yields (land productivity), African demographic trends support the case for mechanisation. Africa, with the fastest growing population in the world, has 60% of her people below the age of 25, making it a continent of youth. In contrast, the average farming population age has over the period increased to 60 yrs. The future of African agriculture therefore lies with African youth. Mechanisation holds strong potential to generate strong attraction for youth engagement in agriculture as it circumvents the drudgery associated with the use of low input implements under subsistence farming. It also encourages efficiency in production and the net benefits to the farmer are higher.

There is also a growing feminisation of smallholder agriculture, especially as women are increasingly left in charge of the family farm with less time for tending these farms as more men engage in search of jobs with higher and sustainable incomes. The feminisation of agriculture further imposes the need to empower women with accessible mechanisation to efficiently maximise their limited time during farming operations for enhanced and sustainable productivity.

Despite the obvious need and recognition for mechanisation, several constraints face the continent in harnessing the benefits of mechanisation. Smallholder farmers are resource poor and often have difficulty investing in physical assets in general and in agricultural machinery in particular.

AATF identifies this key mechanisation gap as a major bottleneck to African agricultural transformation; and through its public private partnership model initiated a project – the Cassava Mechanisation and Agro-processing Project (CAMAP) – that aims to transform African agriculture through mechanisation. The selection of cassava as a choice case crop that has a long growth cycle is also strategic, given its highly challenging biology of being vegetatively propagated, and having its most important economic part (the root) underground, as well as other key considerations regarding its role in food security and rural economic development in Africa.

Under the project, smallholder farmers have been organised and clustered to facilitate access to mechanisation tools for production with links to expanded markets and marketing platforms for the uptake and trade of high volume of cassava roots resulting from increased productivity (300% increase in yield over average cassava yield in Africa). Over 18,000 hectares have been mechanised and credit facilities and government support to mechanisation have been enabled through the project.

Mechanisation encourages Nigerian graduate students to take up cassava farming as a business

CAMAP youth farmers in Iseyin, Oyo State, Nigeria

In Nigeria as in most of Africa, promoting farming as a career for the youth is very often a losing proposition. Judging from the fortunes of their parents, many of them see agriculture as a tedious, risky and unrewarding occupation. Most opt to migrate to the cities and try their luck there, rather than stay in the rural areas to pursue a career in agriculture.

In Oyo State of Nigeria, a group of university graduates are attracting attention with their choice of agriculture as a career, a field that is especially shunned by educated youths in Nigeria.

Calling themselves Path P, the group of 15 university and polytechnic graduates believe they are on to something that is preferable to jostling for scarce office jobs. The group approached AATF – thorough the Cassava Mechanisation and Agro-processing Project (CAMAP) project to assist them in mechanising their 40ha cassava field.

AATF has been working with smallholder farmers under CAMAP since 2013 to offer productivity solutions for cassava farming. CAMAP aims to improve cassava production through mechanisation for sustainable food security and commercialisation towards enhanced incomes and livelihoods of farmers in SSA.

The project has accessed cassava-specific field implements including cassava planters, root diggers, cultivators, and boom sprayers.

Some of the documented results from CAMAP activities show that fresh root yields of cassava on farmer pilot fields in Nigeria rose to over 30 t/ha, three times higher than the national average. It also takes only a day to plant nine 9ha hectares using mechanisation compared to 30 days to plant only 1ha manually.

To support the upcoming youthful cassava farmers, CAMAP has linked Path P youth group with mechanisation services while building their capacity to do farming as a business based on best cassava agronomic practices. Practical trainings are provided on machine operation and maintenance.

'This is the first time that I am witnessing the operations of the harrow thanks to CAMAP project. We never imagined that this could be possible, this is indeed a unique revolution for cassava in Nigeria,' said Pat P group leader, Abdulrazak Waheed.

'Our access to these set of technologies has rekindled our hope and motivated us to see farming as a real business rather than just a way of life,' Mr Waheed added.

In its formative stages, the youth group leased out 40ha of land while CAMAP provided mechanisation services like ploughing, harrowing, planting, spraying and planting.

The joint cassava production between CAMAP and Path P group will serve as a model farm to Oyo State in offering mechanisation training. Proceeds from the farming will be shared between the project and the youth group.

Transforming the cassava subsector in Zambia with mechanisation

Traders hawk fresh cassava tubers at Mbanyutu market in Kaoma district, Western province, Zambia

For many farmers in Zambia, there is the traditional way of cassava farming, practised for generations, but which has not changed their economic status in any significant way.

Despite owning large tracts of land, most of it remains uncultivated. In the cassava growing areas such as Mansa and Samfya districts of Luapula province and Kaoma district of the Western province, farmers have let bushes and thickets take up much of the field. Shift cultivation is the norm here, with most of the cultivated land falling under maize thanks to the government's subsidised inputs for growing the crop.

Opening of new land is a laborious undertaking, with farmers often using crude tools such as machetes to slash through the thick shrubbery.

A mother prepares cassava flour using pestle and mortar in Samfya district – this traditional method of processing cassava is cumbersome and can only be used for subsistence purposes

Cassava growing is usually a side activity despite its great potential both as a food and industrial crop. Use of fertiliser is minimal, and cassava is usually planted on land which has previously been used to grow maize for several seasons leaving it exhausted of nutrients.

Harvesting is also a cumbersome affair given the amount of effort required to dig around the stems before pulling out the tubers. After the gruesome task of harvesting, farmers have to sun-dry the cassava for many days before they can either sell it, or prepare it for home use through pounding using pestle and mortar or taking it for milling.

All these challenges have rendered intensive cassava production unattractive and uneconomical. Production levels are as low as 8 tonnes of fresh tubers per ha compared to a yield potential of over 30 tonnes for some varieties.

Samwel Chilinda is one of the farmers who believes that things are set to change. He is one of the farmers who was chosen to participate in the initial activities of AATF's Cassava Mechanisation and Agro-processing Project (CAMAP) in Zambia which began in December 2012.

During CAMP's first field days in Mansa and Samfya districts in June 2013, farmers were excited to see the outstanding performance of the crop which tripled demand for project services from 50 to 150 in the two districts.

The project is facilitating farmers to access modern technologies to mechanise cassava production and processing. These include tractors for land preparation; cassava planters with a capacity of planting up to 10 hectares per day; cassava uprooters able to harvest up to 10 hectares per day; as well as anassorted small and medium scale processing equipment.

A cassava field in Mansa, Zambia planted using traditional practices where no inputs are used

The project is also promoting use of appropriate agronomic practices in cassava production as well as building the capacity of farmers to do farming as a business. The AATF project will go further to facilitate farmer linkages with cassava processors and other market outlets for their produce.

Farmers keenly follow a demonstration of a 2-row cassava planter during a field day held in June 2013 in Samfya district, Zambia

Mechanisation will bring a difference: Convictions of a cassava smallholder farmer

Mrs Amusan (centre) at her farm with Dr Denis T Kyetere, Executive Director AATF (left) and Prof Idah Sithole-Niang', Board Chair AATF (right)

Not one to give up, Mrs Amusan leased another piece of land, but had to spend a lot of money preparing it, as it had been fallow for over six years and even needed a wide access road to allow movement of tractors.

These were just a few challenges, but her conviction that CAMAP would open new possibilities for her drove her on. CAMAP was helping farmers in the area to overcome manual processes that had discouraged cassava farmers, leading many to abandon the crop.

"By the time I was through with preparing my piece of land all other farmers had their land already ploughed and harrowed and planting was underway. The harrowing equipment had even been taken back," she remembers.

When eventually she managed to get her land planted, all the pain of initial setbacks was quickly forgotten.

Today, Mrs Amusan cannot hold back her joy as she watches her flourishing and healthy cassava crop grow. She looks forward to the day a tractor drawn cassava harvester will drive into her farm to reap what she had painfully sown.

The road Mrs Amusan had to clear to allow for movement of farm machinery to her new farm

Pest management

Pests have for ages persisted as some of the African farmer's biggest enemies. A significant part of the factors that cause low productivity of yield in the developing world can be attributed to the activities or effects of pests either on the field (pre-harvest) or in storage (post-harvest).

Crop losses due to pests are a major threat to food and nutrition security in Africa with severe consequences on the income of rural families on the continent. The yield losses, both in quantity and quality, could be estimated at 40%–50%, with the monetary value being worth billions of US dollars annually depending on the severity of the pest pressure.

For a long time these pests have been controlled mainly with chemical pesticides, but control using chemicals is expensive, unsustainable and hazardous to the environment, while also a health threat to smallholder farmers who are not adequately informed of the side effects of such chemicals.

The smallholder farmers in Africa on whose shoulders the continent's agricultural growth and development revolves are the core interest of AATF and its partners. AATF has activated great initiatives on pest management to control key devastating crop pests (and associated diseases) especially for those where conventional approaches have not offered effective control. AATF and partners have explored novel approaches to address *Maruca* sp. in cowpea, stem borer and Fall Armyworm in maize, *Xanthomas sp.* in banana, cassava and enset (in the absence of good natural genetic variation in the germplasm of these crops.

The key focus is on developing technologies for pest management that are affordable, safe, effective and environmentally friendly. So far, these technologies have been seen to not only control the pests but also contribute to better health for people and environment through reduction of chemical spraying. It is expected that these technologies will be easily accessible to farmers through AATF's deployment and commercialisation platforms.

The testimonies of farmers who have planted new seed varieties such as StrigAway maize, plus the evidence of a healthy crop, have been critical in spreading the word to fellow farmers who have been hesitant to take up new technologies.

From petty trader to major supplier, thanks to StrigAway

Eunice Anyango addresses journalists at her farm in Nyakach – Kisumu County, Kenya in 2017

Before she decided to switch to StrigAway, the yield from Eunice Anyango's five-acre farm could barely feed her family, with any little surplus being sold in the tiny 2kg tins known as gorogoro in the local market.

'We would faithfully plant the variety known locally as "farmer's choice" and wait for the little harvest. Whatever was not 'eaten' by *kayongo* (local name for *Striga* weed) would come out stunted but we had no option but to hope for a better harvest the following season,' says Eunice.

Like many other farmers here in Nyakach, Kisumu County, Eunice was for long at the mercy of the devastation caused by *Striga* weed on her farm. Despite her faithful use of fertiliser, weeding and spraying, the most she would harvest from the five acres was three 90kg bags.

The *Striga* weed is a stubborn pest that continues to hamper the productivity of staples such as maize, sorghum and millet in Sub-Saharan Africa. By robbing its host of water and nutrients, and producing harmful toxins, the weed can cause losses of up to 80%. In Africa, *Striga* infests as much as 40 million hectares of smallholder farmland.

In collaboration with public and private partners, AATF is promoting the use of StrigAway, a herbicide-tolerant maize seed commercialised in Africa.

It was while attending a field demonstration led by Caleb Adede, a field officer with AATF, that Eunice first heard of StrigAway. She saw how the demonstration farm had thrived after using the herbicide-coated maize seed that was being sold as StrigAway and known locally as *Ua Kayongo*.

Four years later, Eunice has enough harvest to enable her store some as she waits for times when the demand for maize is high. Her family is comfortably paying for their son's university education, and they have even started constructing a permanent residential house.

'I am now supplying maize to the local boarding school and I cannot forget the first time I held a cheque worth Ksh100,000 in my hands,' says Eunice Anyango, looking back at the days when all she managed was a few 2kg tins which she took to the local retail market.

Working with AATF Eunice is now keen on spreading the good news to neighbouring farmers. At her 5-acre farm, she has a *Striga*-infested section which she says she has been using to demonstrate to other farmers the difference between StrigAway maize seeds and the local variety.

'I am now supplying maize to the local boarding school and I cannot forget the first time I held a cheque worth Ksh100,000 in my hands,'
Eunice Anyango

The wonder seed that kills *Striga* – StrigAway maize

Timothy Ochiel in his Striga infested maize farm in August 2012.

When Pastor Timothy Nyagol was approached by agricultural extension officers to give part of his farm for trials on a seed that could conquer *Striga*, he quickly agreed, confident that he would prove that there was no solution to the weed.

'I never thought that *Striga* can be controlled. I gave them the worst *Striga*-infested portion of my land,' says Pastor Timothy, a farmer in Simbiri village in Rachuonyo, Nyanza Province, Kenya.

Over the years farmers have tried different methods to deal with *Striga*. Some of the practices include uprooting and burning *Striga* plants, field sanitation (use of *Striga*-free planting material and clean tools), crop rotation, intercropping, organic matter usage, push-pull system and herbicide coated maize seed.

AATF and partners are promoting use of StrigAway® maize, an Imazapyr resistant herbicide-coated maize seed, which kills *Striga* before it damages the crop.

'I have never seen a wonder seed like this that kills *Striga*,' commented Pastor Timothy as he explained the transformation on the portion he had given for the demonstration.

Pastor Timothy said farmers in the neighbourhood streamed in every day to marvel at the development on his farm and asked him where they could get the seed known by its brand name StrigAway or *Ua kayongo* as locally referred to meaning *'Kill Striga'*.

The transformation was courtesy of AATF's partnership in the Integrated *Striga* Management in Africa (ISMA) project. where it managed demonstration plots such as the one on Timothy's farm. Timothy allowed the project to use a 0.25 acre piece of land on his farm which he said he had no use for since no maize would grow there.

Timothy, was later more surprised when he harvested more maize from the demonstration plot than from his other 1.5 acres.

Before *Striga* infestation, he said he used to get eight bags of maize from the 1.5 acres a few years back, but the problem became so bad later that he would be lucky to get four bags.

It was a pleasant surprise when, from the 0.25-acre demo plot, he harvested four bags of maize during the first round. He said he could not wait for the second round of field demonstrations.

Asked what he and his neighbours had learnt from the demonstration field, Timothy said that they had learnt that *Striga* can be controlled and that by adopting new technologies they can get very good harvests. He estimated that he would get more than 18 bags of maize from his 1.5 acre plot using the new seed.

Asked what he and his neighbours had learnt from the demonstration field, Timothy said that they had learnt that *Striga* can be controlled and that by adopting new technologies they can get very good harvests.

StrigAway maize has changed my farming fortunes – Dick Morgan

Dick Morgan in his farm in December 2012

Sometime back, the beautiful pink flowers on Dickson Morgan's farm in Itando village, Vihiga District was a sign of the disdain with which his late father held him. His father had bequeathed him this 'cursed' piece of land to ensure that his family would never have enough, or so he thought.

For several years, despair was the only thing he knew as a farmer, surviving on a mix of crops like avocado, sweet potatoes, various types of vegetable, and beans in an attempt to get the most out of the modest piece of land.

He says he had no idea that the beautiful pink flowers growing all over were *Striga*, and that it was the source of poor maize yields on the farm. 'We actually thought our land had been cursed by someone. I thought my father disliked me and had given me this piece of land as my inheritance,' he says.

That was until 2005 when an organisation known as the Forum for Organic Resource Management and Agricultural Technology (FORMAT) introduced the StrigAway Imazapyr Resistant maize (IR) technology to people in this area.

StrigAway™ comprises conventionally bred herbicide-resistant maize varieties and Imazapyr seed treatment, a herbicide seed coating. AATF is working with partners to bring StrigAway to smallholder farmers in Kenya, Tanzania, and Uganda, where *Striga* affects approximately 1.4 million hectares of land.

'We actually thought our land had been cursed by someone. I thought my father disliked me and had given me this piece of land as my inheritance,'
Dick Mogan

To accomplish this, AATF is providing technical support for local seed companies to ensure that the seed is properly treated and made widely available for purchase.

'They educated us that the flowers we had on our farms were dangerous weeds. They gave me a quarter kilogramme of IR maize to try and I saw a significant increase in maize yields and also in the reduction of the *Striga* weed on my farm,' says Morgan.

He adds that after two seasons of planting IR maize, his farm was almost entirely rid of *Striga*. Morgan says that land sizes in Vihiga are small and for one to get the best out of the land they must use various technologies to improve yields. However, he adds that education on the technologies is crucial.

'IR maize comes with unique planting instructions which at first confused me. Aspects like not planting it together with other seeds or touching other seed before washing hands did not make sense. Through training from FORMAT I got to understand and I adopted the correct planting requirements,' explains Morgan.

Morgan was part of the 700-member Mwangaza Farmers Group in the village, where members come together to purchase the IR maize seed in bulk. This, they said, would help get rid of the *Striga* in the farms in the village.

Mrs Morgan with roasted IR maize which is liked by many for its sweet taste

StrigAway triples maize yield of Kenya farmers after weeding out crop killer

A farm in Siaya, Kenya, devastated by Striga

Three years ago, Eunice Odhiambo – a farmer and a mother of four – almost gave up on farming. Her one-and-a-half-acre piece of land had been ravaged by the *Striga* weed, known locally as *kayongo*.

'Sometimes I would be optimistic about better harvest following good weather conditions, but this did not happen. I could only get one or two '*gorogoro*' (a 2kg tin) due to the *Striga* weed choking my farm.'

Things changed for Eunice when she met Caleb Adede, a field officer with AATF, who introduced her to the StrigaAway maize seed.

The most agonising damage caused by insect pests is felt by maize farmers, given the central place the crop holds on the continent. By robbing its host of water and nutrients, *Striga* or 'witchweed' has in some cases caused losses of up to 80%.

For a long time, farmers have been manually pulling out the weed, which is labour-intensive and ineffective. With its large number of seeds that remain dormant but viable for years, *Striga* has continued to resist many control methods. In despair, some small-scale farmers have abandoned parts of their farms.

The goal of AATF's Striga Control Project is to increase on-farm maize grain yields by significantly reducing *Striga* weed infestation on smallholder farms in Kenya, Tanzania and Uganda. To accomplish this, the project is facilitating access to and delivery of Imazapyr-Resistant (IR) maize technology, which

is also referred to by its trade name StrigAway®.

StrigAway® is the first herbicide-tolerant maize seed commercialised in Africa, and prevents infestation of Striga, otherwise known as 'witchweed' – a parasitic plant that attaches to maize roots and causes major crop losses, particularly in East Africa.

'Over the years, my yield has increased from the initial 1 *gorogoro* to not less than four sacks,' Eunice says.

She can now cater to her subsistence needs as well as pay school fees for her children.

'I'm a proud farmer and since I do this as a business, I pocket a tidy sum of money from my farm. After harvesting I get orders to supply maize to schools in the area,'' she said.

She and other farmers in the area have joined hands in educating their counterparts about the new technology. As the country grapples with maize shortage, she is stress-free.

AATF has been working with farmers in *Striga* affected areas, demonstrating different varieties and comparing yield during harvest time. They are deploying the StrigAway IR maize to smallholder farmers in Sub-Saharan Africa, as well as encouraging farmers to incorporate soil fertility practices such as legume rotation and use of fertiliser.

'Over the years, my yield has increased from the initial 1 gorogoro (a 2kg tin) to not less than four sacks,' **Eunice Odhiambo**

Victory over *Striga* weed

Evelyne Odogba in her farm planted with StrigaAway maize seed in 2017

Despite an attack by the Fall Armyworm on her Esikhokho Village farm in Luanda, Evelyne Odogba is still happy with the harvest this season. It is her first harvest after planting StrigAway maize seeds on her half-acre field.

'It is not so much, but this is the best crop ever seen in my farm,' says Evelyne, a 30-year-old mother of six.

Evelyne explains that she has often considered abandoning planting maize on her farm, as whatever harvest she got was never enough to feed her family.

'Can you believe the most I have ever harvested is only 12kg after all my labour? I have often thought of switching to sweet potatoes, ground nuts and cassava as planting maize was just a waste of time and money,' she says, noting that her neighbour whose field was of equal size had harvested almost 20 times more.

An act of kindness by Evelyne's neighbour is now convincing her to give the maize crop another chance. The neighbour, Arthur Arodho, chairs the Emmalova Farmers Group where Evelyne is a member. He is one of the people in the area who have used StrigAway seeds.

'I was deeply disturbed by the state of her farm as I could see how miserable the family had become. They had to borrow maize from my family and others within the neighbourhood whose farms were not as affected,' says Arthur, explaining how he one day decided to buy a packet of StrigAway for Evelyne.

Evelyne says she planted the seeds immediately, but unfortunately the maize was attacked by Fall Armyworms.

'This was my hope, I have a child going to secondary school and I was depending on the sales to boost me to take her to school, now I don't know. On the bright side, the worm attacked when my maize was mature, so the devastation was not so bad, it was a bumper harvest compared to what I am used to!'

'I am sure I will soon take better care of my children,' she says with a big smile, adding that maybe she will even get money to visit a dentist about the constant trouble with her teeth, two of which she has lost.

Fighting ignorance through new technology

Samuel Owiti Awino at his farm in February 2016

The message from agriculture extension officers sounded like a bad joke to Samuel Owiti Awino and his fellow farmers in Homa Bay.

'Even though we knew they were experts, there were so many questions as to their motive. We initially laughed off a suggestion that if we prepared the fields properly, used the right seeds and used fertilisers, our harvests would multiply several times,' remembers Samuel.

He says, however, that the farmers had been tormented so much by unreliable rains and the destructive *Striga* weed that they were ready to try anything.

'When you are sick and you don't know what ails you, you will take any concoction hoping that one of them will eventually cure you. That is the only reason we decided to give the extension workers our ears,' he says.

So it was that Samuel was one of the farmers who encountered agricultural extension services during a field day facilitated by AATF in Homabay Town. They introduced him to new ideas such as soil testing, planting appropriate crops, and the use of certified seeds and fertiliser.

He got to learn about the Imazapyr-Resistant (IR) seeds, also known as StrigAway or *Ua Kayongo* technology that is changing fortunes in the Lake Victoria region. He was told that *Striga* survives by siphoning off water and nutrients from the host crops for its own growth. It can reduce output by 80%.

When he was approached to be part of the demonstration group whose

farms would be used as exhibition sites, he gave them a parcel he had long abandoned due to its low yields.

To his surprise even his most fertile land did not produce half of what he eventually got from the demonstration plot he had up till then neglected – the parcel he had abandoned.

'I managed to harvest 140kg from the demo plot and only got a few buckets from where I planted the *kienyeji* (seeds recycled from previous harvest)', he recalls.

Ignorance is a key contributor to food insecurity in Kenya, according to Awino. 'Many people have been growing maize for a long time and their choice of seeds is usually informed by what they see others plant. They don't seek expert advice. And it takes time for them to accept latest technologies,' says Awino.

Farmer trainings included pre- and post-planting sessions. During the planting period, farmers are trained in safe use aspects of StrigAway™ technology to avoid mishandling and environmental hazards due to poor

application. Post-harvest trainings include topics such as harvesting conditions, drying practices, maize shelling, good grain storage and evaluation of yield advantage of StrigAway.

Samuel is now a delighted man. He no longer depends on the hand of fate to give him a bumper crop. The StrigAway seeds came in handy. He can now afford food for his family even as he handily pays school fees for those who depend on him.

'When you are sick and you don't know what ails you, you will take any concoction hoping that one of them will eventually cure you. That is the only reason we decided to give the extension workers our ears,' **Samuel Awino**

Alhaji Makura looks forward to reduced spraying with pod borer-resistant cowpea

Mu'awi Isa Makura on his plot in the CFT site in Talata Mafara

'I am happy this new cowpea will stop this insect and I am also glad that we can harvest early compared to the variety we have been planting. This way we can make money.' **Mu'awi Isa Makura**

Mu'awi Isa Makura, 60, has been farming cowpeas for 15 years and is one of the six farmers sampling the PBR cowpea variety in Talata Mafara.

'*Maruca* insect damages our beans and usually causes a lot of problems for us. Sometimes instead of getting 20 bags at harvest per hectare, we end up with 5 to 6 bags per hectare, I am happy this new cowpea will stop this insect and I am also glad that we can harvest early compared to the variety we have been planting. This way we can make money and solve some of our immediate financial problems,' says Makura.

Alhaji Makura expressed his joy in relation to reduction in the use of agro-chemicals: 'Chemicals are expensive and it affects our income after harvest, and we were told it's not good for our health. We sprayed this farm only twice and the crop did well. I normally spray my farm eight times or more before harvest, indeed I am happy and hopeful.'

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