IITA
Research to Nourish Africa

CGIAR

IITA 2014 ANNUAL REPORT

Moving Forward

IITA 2014 ANNUAL REPORT

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Cover photo: A woman farmer in a farmers' meeting organized by the Africa RISING project in Babati, Tanzania. Photo by C. Njuguna

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FROM THE DIRECTOR GENERAL

It is my pleasure to present to you the IITA Annual Report for 2014.

Aptly themed Moving Forward, this report highlights our research-for-development and innovative partnership efforts for 2014 which bring us closer to our goal of lifting 25 percent of African households above the poverty line. We are moving forward to achieving this goal by continuously increasing average farm income, buoyed by the continuing support of our partners and donors and enforced by the steady commitment and hard work of our staff.

This year saw IITA make significant scientific strides in the areas of biotechnology, genetic engineering, agribusiness, climate change research, and natural resource management. In this report, we highlight our breakthroughs in genetic engineering of banana, to make it resistant to Xanthomonas Wilt. As millions of Africans depend on banana for food and income, we are endeavouring to build up their defences to withstand biological and non-biological stresses by improving the crop at the genetic level and complementing this research with conventional breeding efforts. We are also about to deepen our understanding of farm management solutions and foster the further improvement of best practices for plant health.

Through various entrepreneurial initiatives, our Youth Agripreneurs Program has shown that agriculture is a viable business option, particularly for young Africans. Similarly, our Business Incubation Platform and its units – GoSeed, NoduMax, Aflasafe – also the IITA Forest – have successfully demonstrated that research could be transformed into ventures that not only generate income but also protect African crops and their environment, improve yields and can be integrated into new ways of looking at sustainable intensification.

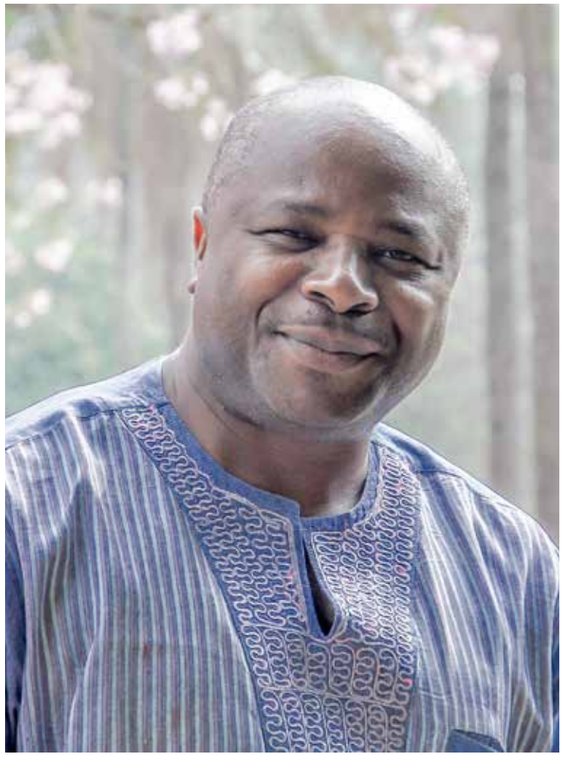
In 2014, the CGIAR Research Program on Integrated Systems for the Humid Tropics (Humidtropics), which IITA leads, made positive strides towards fulfilling its commitment to create impact on farm families in tackling poverty, hunger, and environmental degradation. This work was done through two principal channels: strengthening the systems research dimension in various research activities of the CGIAR and other core partners; and establishing a number of projects in integrated systems research in various action sites.

Another important aspect of our R4D initiatives this year has been to further understand the effects of climate change on Africa's agriculture and to develop technology-based interventions to help farmers cope. We have also put a lot of effort in advocating for an enabling policy environment that would support and sustain climate change adaptation strategies for smallholder farmers.
The soil is the farmer's lifeline. A pillar of our research work is anchored in protecting and improving this vital agricultural asset, highlighted by our COMPRO and N2Africa projects which we feature in this report.

And of course, we continued to invest in building the capacities of farmers, students, and other researchers from our national and regional partners in West, Central, East, and Southern Africa. We also forged new ties with a number of private and public sector partners across sub-Saharan Africa.

The year 2014 has been a productive and successful year for IITA, and we are well on track. I am counting on your continuing support – our partners, donors, supporters, and staff – to make the coming years even more productive and successful.

Together, let's move forward!



Dr Nteranya Sanginga
DIRECTOR GENERAL

"The year 2014 has been a productive and successful year for IITA, and we are well on track."

FROM THE BOARD CHAIR

IITA is the lead center on the CGIAR research program (CRP) Integrated Systems for the Humid Tropics which is the focal point for the Institute's R4D programs. Flagship projects are underway in south-east Asia, Central America, and two areas of Africa. Six CGIAR centers are partners in Humidtropics and the program has numerous non-CGIAR collaborators. IITA is a partner in eight other CRPs with major research activities in Roots, Tubers and Bananas, MAIZE, and Grain Legumes.

The mission of IITA is to be the leading research partner facilitating agricultural solutions to overcome hunger, poverty, and natural resource degradation throughout the tropics. The Institute's Strategic Plan 2012-2020 established a goal of lifting 11 million people out of poverty and revitalizing 7.5 million hectares of degraded land by 2020. This is an ambitious target; however, the significant increase in research capacity and the quality and relevance of the Institute's programs will facilitate its achievement. The Board of Trustees is committed to providing leadership and oversight to the Institute in the achievement of this goal.

By the end of 2014, IITA had completed the first phase of its Strategic Plan. Over the last three years, all Institute research has been aligned with the CGIAR Research Programs; funding and the number of research partners have been increased; and infrastructure has been improved. The 2014 budget was substantially increased over that of 2013; over the three-year period, the annual funding of the Institute has increased by more than 250%. This has led to a substantial increase in the numbers of both national and international staff, considerably expanding the research capacity of IITA. To accommodate this growth, the Science Building at the Central African Hub in Kalambo, DRC, was officially opened in June 2014. Construction on the Science Building in the Southern African Hub in Lusaka, Zambia, is proceeding well, and it will be completed in 2015. The second phase of the Strategic Plan (2015-2017) will continue to focus on the delivery of IITA's research technologies to producers in the tropics.

To facilitate the delivery of it products, IITA established a Business Incubation Platform (BIP) at its main headquarters in Ibadan. The goal of the BIP is to facilitate the scaling up of technologies developed from IITA's research programs and to advance public-private partnerships to deliver these technologies to African farmers. In 2014, the three production components of the BIP, Aflasafe, Nodumax and GoSeed, were fully operational; an Advisory Committee was established and a CEO was recruited.

I am pleased to serve as Chair of the Board of this well-managed Institute and would like to thank my colleagues on the Board for their dedication to IITA's success. The Board expresses its appreciation to DG Sanginga and his Senior Management team for the significant accomplishments over the past three years and for their vision for the future. We congratulate the scientists and support staff for the excellent research being conducted. Finally, we express our appreciation to our funders who recognize the importance of the work being done and have confidence in the Institute's ability to do it.

Dr Bruce Coulman
BOARD CHAIR

"lifting 11 million people out of poverty and revitalizing 7.5 million hectares of degraded land"

OUR VISION OF SUCCESS

OUR VISION OF SUCCESS

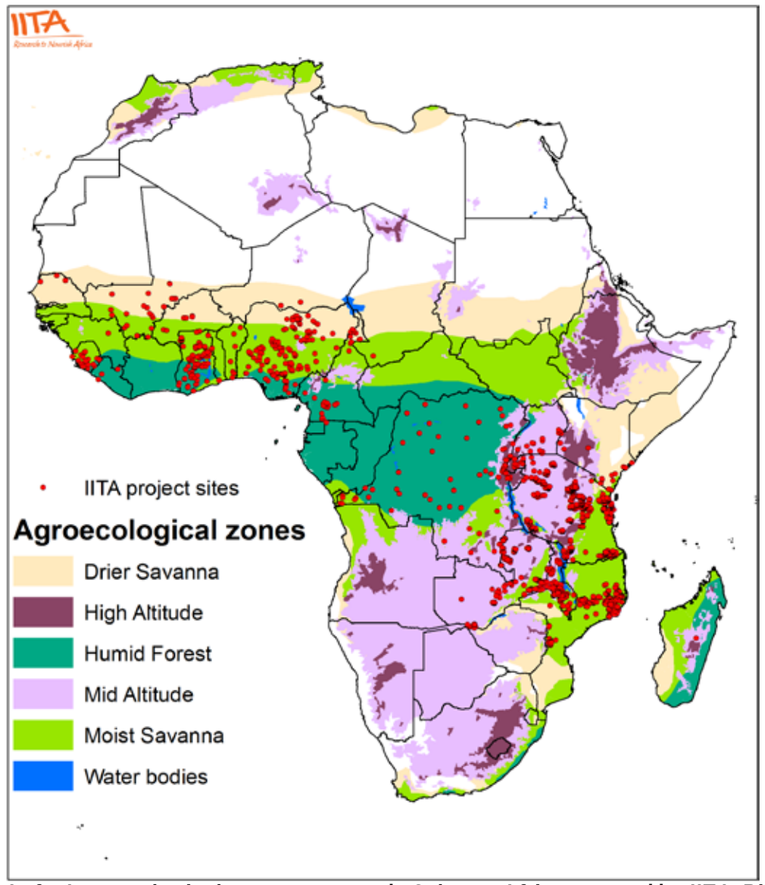
IITA's vision of success is in line with that of CGIAR and focuses on the four system level outcomes (SLO) described in CGIAR's Strategic Results Framework (SRF), namely, (1) increase in food security, (2) reduction of rural poverty, (3) reduction of undernutrition, and (4) more sustainable management of natural resources.

IITA will advance these SLOs by increasing the yields of major staple food crops, such as cassava, yam, maize, banana/plantain, soybean, and cowpea, by 60%; increasing average farm income by 50%; lifting 15% of poor households—over 11 million Africans—above the poverty line; reducing the number of malnourished children by 30%; and restoring and revitalizing 40% of degrading farmlands to sustainable resource management—equivalent to about 7.5 million hectares.

IITA will operate through decentralized but integrated regional research programs working on major agricultural constraints in Africa, specifically on crops, farming systems, and their natural resource base, and the CGIAR Research Programs that foster innovative partnerships and the outscaling of technologies developed in sub-Saharan Africa to the global tropics.

OUR MISSION

To offer a leading research partnership that facilitates agricultural solutions for hunger, poverty, and natural resource degradation throughout the tropics.



Left: Agroecological zones across sub-Saharan Africa covered by IITA. Right: Percentage of people living below $1.25/day across sub-Saharan Africa.

RESEARCH BREAKTHROUGH

Standing Up to Banana Xanthomonas Wilt

Spotlight on Leena Tripathi

Genetic Engineering in Cassava

STANDING UP TO BANANA XANTHOMONAS WILT

By Leena Tripathi

Banana is undoubtedly one of the world's most important crops. However, a myriad pests and diseases are threatening its very existence. Although nature had provided the plant with innate defenses that enabled it to survive for millennia, these new challenges might eventually spell its doom.

Banana *Xanthomonas* wilt (BXW) is caused by *Xanthomonas campestris* pv. *musacearum* (Xcm). It is one the biggest threats to banana production – and to the livelihoods of thousands of smallholder growers – in East and Central Africa. BXW-related economic losses in these regions are estimated at US$2-8 billion over the last decade. Currently, there are no commercial chemicals, biocontrol agents, or resistant cultivars available to control the BXW pathogen though it could be managed by following specific banana field management which IITA researchers are exploring as well. However, these practices are labor-intensive and smallholder growers incur significant losses as they often involve uprooting of banana suckers.

Confined field trial of banana. Source: L. Tripathi

In the absence of known resistances among currently cultivated banana, IITA researchers under the leadership of Leena Tripathi and those of Uganda-based National Agricultural Research Organization (NARO) have successfully developed transgenic banana by inserting two genes from sweet pepper, the Hypersensitive Response-Assisting Protein gene (*HRAP*) and Plant Ferredoxin-Like Protein gene (*PFLP*). The best performing 65 resistant lines selected through glasshouse screening were further evaluated against Xcm for three successive crop cycles in confined field trials (CFTs) at the National Agriculture Research Laboratories (NARL) in Kawanda, Uganda. The majority of transgenic lines were found to have significantly higher levels of resistance compared with control non-transgenic plants with eleven, showing 100% disease resistance with both mother and ratoon crops. These results were published in the world-leading scientific journal *Nature Biotechnology* (Tripathi *et al.* 2014 http://0-www.nature.com.es.library.du.ac.bd/nbt/journal/v32/n9/full/nbt.3007.html), and her approach could be tweaked to protect other crops in more countries against similar bacterial diseases.

Aside from full resistance to BXW, the transformed lines also showed characteristics of flowering and yield (bunch weight and fruit size) comparable to those of non-transgenic varieties. To get stronger proof of the concept for product development, Tripathi and her team are evaluating the ten promising lines in a second field trial. The second trial will use more replicates to assess disease resistance over time as well as the yield performance. This trial will be expanded to multiple locations to capture the effects of different environments on disease resistance for these lines.

It is well known that pathogens can evolve and "breakdown" disease resistance. To enhance the

resistance, Tripathi has stacked these two genes together in the same lines which are under glasshouse trial. The promising lines will be evaluated in 2015 in CFTs in Kenya in collaboration with the Kenya Agricultural and Livestock Research Organization (KALRO), and in Uganda with NARO.

The two wilt-resistance genes – *PFLP* and *HRAP* – were licensed by the African Agricultural Technology Foundation (AATF) on a royalty-free basis from the patent holder Academia Sinica in Taiwan. The HRAP and PFLP proteins are not listed as being a potential allergen in AllergenOnline, indicating that they should be safe for human consumption. They are widely distributed throughout a broad range of plant species, including rice and fruits which are eaten raw, such as sweet pepper. The transgenic lines will be tested for food and environmental safety in compliance with biosafety regulations. Since most bananas are sterile their mode of propagation makes the risk of gene flow from one banana to another or to another crop species non-existent.

Banana plantation. Source: M. Onyango, KARI

ABOUT THE AUTHOR

Leena Tripathi is the senior scientist leading plant transformation research at IITA in Nairobi, Kenya. She began her career as a research scientist at the University of North Carolina, Greensboro, NC, USA, in 1999. She holds a PhD in Plant Molecular Biology from the National Botanical Research Institute, Lucknow, India. Her primary research focuses on the genetic improvement of banana, plantain, enset, cassava, and yam for disease and pest resistance. She has established the 'Genetic Transformation Platform' for banana, plantain, cassava, and yam; the most important food crops in sub-Saharan Africa. In the past 10 years she has trained more than 30 post-graduate students and 150 short-term trainees including researchers and regulators in the field of plant transformation and molecular biology. She has written Journal articles and book chapters and presented papers in conferences and workshops. She is a member of many scientific societies, and editor and reviewer for books and several International Journals. She has received a number of awards and scholarships. IITA recognized her contributions to research as one of the 'Top Scientists at IITA' in 2005 and she received the IITA Board of Trustees Annual Excellence Award in 2013 for "Outstanding Scientist". Her research has been featured in more than 150 national and international media outlets.

SPOT LIGHT ON LEENA TRIPATHI

In a candid Q & A, Dr Leena Tripathi, Senior Scientist based in Nairobi, Kenya and the prime mover of IITA's Plant Transformation Research, reveals what makes her tick, what turns her off, her inspiration for being a scientist, her love of bananas, the driving force behind her wanting to improve her favorite fruit, and her thoughts about how technology could help bring about a better life for the poor.

When are you happiest in your work?

As a scientist, I am happiest when I see exciting results from my research or when my work gets recognized or appears in a renowned scientific journal or publication.

Could you work with anybody? What do you expect from the team that you work with and what can they expect from you?

I can pretty much work with anyone as long as the person is ready and motivated to learn and to work. I think it is difficult to work with people who are not excited about what they do and who are not open to learning new things. I want people who literally jump at the opportunity (to learn new things) or who are eager to try new ideas. When I select people, I usually go for the person I think is the most trainable and who is willing to be trained. Those are people of the kind I want (in my team).

What would you consider as the biggest challenge you have ever encountered in your team and how did you overcome it?

There was this time I had someone on my staff that I really couldn't work with. It wasn't so much about the personality but more about the quality of science.. With regard to science, I consider myself a perfectionist. For example, if I don't get a perfect gel (the growth media where virus or bacterial culture is grown in a laboratory) then I'll tell you to do it over and over again until I get what I think is the perfect gel. It really turns me off when my staff are careless, losing notes, not keeping proper records, or not keeping me informed. These might seem very simple things but for me this reflects upon the quality of science and work. In this case, since the person was not delivering according to expectations, the first thing I did was to talk to him, pointing out areas for improvement and how to improve on them. However, even after much advice and guidance, he did not change, so I had no recourse but to let him go. It wasn't easy but it had to be done for the good of the team and the sake of the work.

How do you organize yourself?

My office is pretty much paperless and uncluttered. The only paper you will find on my table is my to-do-list. I work best if my surroundings are clean and organized.

Have you always been how you are now? Tell us about how you were as a kid.

(Laughing) I don't really remember much about when I was growing up. I think I liked "soft" games and played with "light" toys. Rough-housing wasn't really me. However, I do remember that I was tidy, even as a small child – I was always putting things in their proper places. You know the saying "A place for everything and everything in its place"? That's me, even as a kid.

I got a kick out of helping my mom tidy up the house. It's the one thing that my mom, even up to this day, remembers clearly that I did as a child.

Did you always like banana?

You know, I've always felt that me working on banana as a scientist is, like, fate. My mom always tells me that my favorite when I started eating solid food was the banana. She says that when I cried, all she had to do was give me a banana and I'd stop crying. And here I am now, surrounded by and working on my favorite fruit.

Was becoming a scientist Little Leena's first choice? Or did you want to become something else professionally?

As a young child, I had wanted to become a doctor. Looking back, it did not really matter if I became a doctor or a scientist as long as I helped people and communities became better – I have always been passionate about this. I remember that I wanted to become a doctor not just to cure people but rather to invent tools to cure diseases. But growing up in a country such as India where you virtually see doctors everywhere, I asked myself, "Why not be something else?" So during my MSc, I decided to go into food crops research which still fed my passion – to help people have enough to eat. This ideal drove me to go into transgenic technologies. It's like biotechnology but more specific to genetic transformation for crop improvement.

When did you start working on banana? What were the first things did you do research-wise on banana?

My first "professional encounter" with banana was in 2000 during my postdoc days at IITA. Before then, I was working on legume crops. When I came to IITA and was assigned to work on banana, I didn't have an understanding of the crop. I had to learn, and to learn fast. At first, I was hesitant to ask the experts "silly" questions, afraid to be laughed at. So I went to the people on the ground – the field and lab technicians with my queries. I did get some looks of the "this-is-so-simple-why-is-she-even-asking?" kind from time to time, but I was learning so it was okay. This is why I have a lot of respect for these people. A lot of what I know now started from them. And you cannot develop top-shelf protocols for a crop if you don't know the basics about it. So I guess the laughs were well worth it.

My first assignment on banana was to develop a virus-resistant variety. For this, I started developing the protocol for (genetically) modifying banana to make them resistant to certain viral diseases.

What do you think of the suggestion that CGIAR should be promoting more fish and vegetables in African diets?

I think this is irrelevant since I fear that a great number of Africans don't even have access to food yet, in terms of quantity and quality, that is. I think as a CGIAR Center, we need to focus more on access to food, especially that we work for the poor who do not have the means and the resources to buy vegetables because they are more expensive than staples. Basically, what people eat depends on their income. So if incomes increase, people will be able to buy more and diversified food crops. But if there is no improvement in income, people will simply buy what they can afford, which at present are the staples, and forego the more expensive but more nutritious fruits and vegetables. For them, nothing else matters as long as they don't sleep with an empty stomach.

It's 2050 and you have retired. Looking back, what will you remember most as a scientist?

(*Laughs)* That's too early to retire! Seriously, I want to see at least one of the technologies that I helped to develop being actually used by farmers and improving lives. I fondly remember this poor farmer in Uganda whom I met in 2004 and touched my heart. At that time, I went to see this farmer's field through an appointment that a colleague set up for me. On my way to this farmer's field, my colleague asked me to bring a small packet of sugar. It was a strange request, but nevertheless I went with it. Upon reaching the farm, I met this bent, 60-year plus old farmer who was staying alone in a small hut in the middle of his farm. All around were banana plants, but all were badly infected by *Xanthomonas* Wilt. His field was completely devastated. I finally understood what the packet of sugar was for: he did not have enough money even to buy sugar for his tea – a simple thing that most of us take for granted. When I handed him the packet of sugar, he was in tears, thankful for the simple gift. In 2050 when I will be almost the same age as this farmer, I want to see a world where my work has made a difference for people like that farmer. I could then say that I, indeed, lived a full and meaningful life.

What is your stand on a multidisciplinary approach in tackling hunger and poverty, issues that you obviously feel very strongly about?

I believe that hunger and poverty cannot, and must not, be addressed by any single discipline. Disciplines and technologies are like tools in a box. Each is meant for a specific purpose, and when used on its own each tool can only do so much. Bringing this analogy to crop science, there is no one approach or technique that can be considered a magical "silver bullet" that can address multi-faceted problems such as hunger and poverty. If a problem can be solved by conventional breeding, then so be it. If the problem is far more complicated than conventional breeding could handle, then my technology (genetic transformation) could come in to complement it. For example, with regard to the challenge presented by banana *Xanthomonas* Wilt, the only option is to go by way of genetic transformation. There is presently no known resistant variety or germplasm that can be naturally bred to produce an "offspring" that can withstand the disease. Thus, it is also important that the team implementing this technique is also multidisciplinary. For example, although my expertise is in biotechnology, I would still need a team composed of pathologists, socio-economists, microbiologists, and other disciplines if we are to be successful. All of these disciplines are important, and it starts with the breeders because they will know which variety to use initially. It has to be a team effort to effectively achieve something.

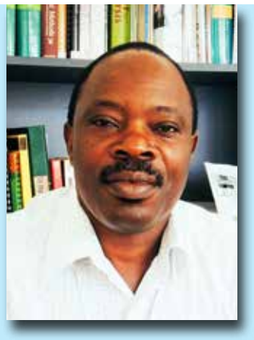
Transformed banana lines.. Source: L Tripathi, IITA

What are your thoughts on population and food security?

As (agricultural) scientists, I don't think we have much to do regarding controlling population growth. However, we can do – and are doing – something about the food production part. We are developing and testing technologies to feed the ballooning population using the same amount of water, land, and natural resources. Of course, this is a daunting task, but I know that it can be done.

Would you say that your research already has had impact on farmers?

Well, the technologies that I am developing are still, technically, in the testing phase, and therefore have not yet reached farmers on a practical scale. Most are still under development, except maybe for the disease diagnostic tools that have reached farmers and are actually being deployed and used in farmers' fields. We'll get there eventually. You might see some of our genetically improved banana and cassava varieties in farmers' fields as early as 2018, but this is a wide forecast and contingent upon how our current work progresses. We are not making any of these public yet since we do not want to "jump the gun" and raise unnecessary expectations or complications as, you know, how some sectors of society are very sensitive when they hear anything "genetic". But this is a subject of discussion for some other time.



Freddy Baijukya

Country Coordinator
N2Africa-Tanzania

After having worked at CIAT in Nairobi, Kenya, for four years, I felt I should be part of IITA to make a difference in my career. IITA offers excellent prospects for research on agroecosystems and environment-related issues to address the challenges faced by smallholder African farmers, who I am part of.

At N2Africa, we focus on how to put nitrogen fixation to work for smallholder farmers through grain legume production. We are building sustainable, long-term partnerships with different stakeholders to enable smallholder farmers gain access to technologies such as inoculants and fertilizers to increase legume production. We are also looking into market aspects of grain legumes.

The project has developed a novel "Development- to-Research' model where technology dissemination and delivery services is at the core, while close monitoring and evaluation facilitates lesson-learning and research into adoption of technologies. N2Africa has managed to rejuvenate rhizobiology research and disseminated legume technology to over 60,000 farming households in Tanzania and over 600,000 farming households in the project countries. We have a multidisciplinary team that allows for flexible approaches in providing targeted solutions to farmers' problems.

GENETIC ENGINEERING FOR CASSAVA VARIETIES

By Evans Nyaboga and Leena Tripathi

IITA has successfully developed a genetic engineering (GE) platform for conferring farmer-preferred cassava varieties with traits such as higher yields, more starch, longer shelf-life, and resistance to pests and diseases including the cassava brown streak (CBSD) and cassava mosaic (CMD).

In Africa where cassava (*Manihot esculenta* Crantz) plays a vital role in people's lives and livelihoods, genetic engineering is hampered by limited infrastructure and know-how. Many African laboratories do not have the capacity and expertise to carry out genetic engineering processes. Presently, most protocols for engineering of cassava use friable embryogenic callus (FEC). These protocols, however, are very variety-specific, developed mainly for cultivar 60444, a model African variety that is no longer grown by farmers. Therefore, IITA aimed to establish a protocol to produce FEC tailor-made for the genetic improvement of African farmer-preferred varieties.

The project started with identifying varieties that would be readily adopted by significant numbers of farmers in sub-Saharan Africa for GE. Six popular local varieties (Serere, Ebwanatereka, Kibandameno, Mkombozi, Albert, and TME14) widely cultivated by farmers in East Africa were selected after consultations with breeders. Following optimization of tissue culture conditions, media composition and timing, FEC were produced from all the varieties and used for genetic transformation. Efficient *Agrobacterium*-mediated transformation protocols have been established for all the six varieties using FEC as a target tissue and β-*glucuronidase* (*gus*A) and *green fluorescent protein* (*gfp)* reporter genes (Fig. 1). The presence, integration, and expression of the transgenes in transgenic plants were confirmed by molecular analysis, histochemical GUS assay and fluorescent microscopy. The results were published in *Frontiers of Plant Science* (Nyaboga et al. 2013; http://www.frontiersin.org/Journal/10.3389/fpls.2013.00526/full).

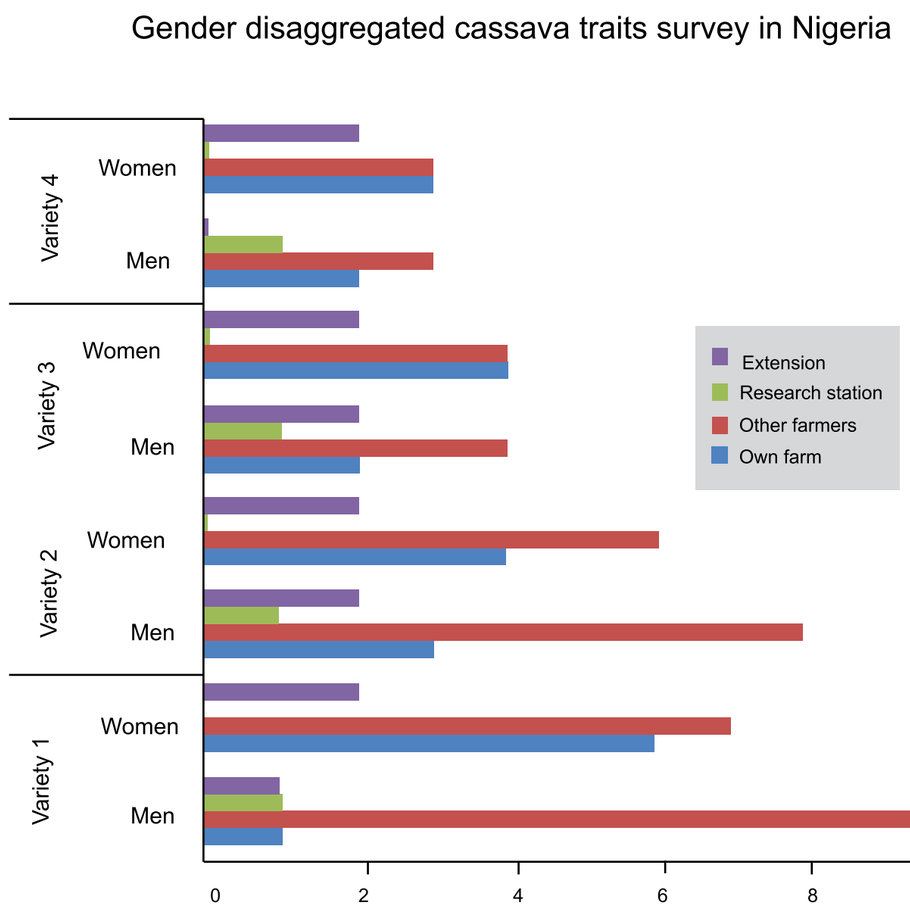


Figure 1. Sources of cassava planting material of men and women.

This is the first reported successful *Agrobacterium*-mediated transformation of African farmer-preferred cassava varieties in a laboratory based in sub-Saharan Africa. This success is the result of close collaboration between IITA (in Kenya) and ETH Zurich. Currently, IITA is working with national partners such as the National

CBSD in cassava. Source: L Kumar, IITA

Crops Resources Research Institute (NaCRRI), Uganda and the Kenya Agricultural and Livestock and Research Organization (KALRO) to build needed capacities in government-run laboratories to establish cassava transformation platforms by training local scientists, students, and technical staff.

CASSAVA BROWN STREAK DISEASE

One of the most devastating diseases of cassava in Africa is Cassava Brown Streak disease or CBSD. It infects roots and makes them rot and unfit for consumption and is considered to be more destructive causing up to 90% reduction in root yield. An important feature of CBSD is that it is prevalent in CMD-resistant varieties that had been deployed to manage the CMD epidemic. Presently, no strong source of robust resistance to CBSD has been identified in farmer- and consumer-preferred varieties.

To urgently address the pending CBSD pandemic in Africa, scientists are looking to GE strategies. Out of the available biotechnology approaches to control plant viral diseases, RNA interference (RNAi) has proven to be the most effective, being successfully used to control numerous viral diseases caused by DNA and RNA viruses. With the RNAi construct provided by Donald Danforth Plant Science Centre (DDPSC), IITA is leading an initiative in East Africa to develop CBSD-resistant transgenic cassava using this technology on a farmer-preferred genotype that is already naturally resistant to CMD, hopefully giving it resistance to both viral disease.

Transgenic cassava multiplied in tubes for transferring to partners for confined field trial. Source: L Tripathi, IITA

ACKNOWLEDGEMENT

IITA would like to thank the USAID for funding our work on the genetic transformation of cassava, as well as the Donald Danforth Plant Science Centre (DDPSC), National Crops Resources Research Institute (NaCRRI) Uganda, Kenya Agriculture and Livestock Research Organization (KALRO), and ETH Zurich, Switzerland, for the invaluable partnership in this endeavor.

OUR STORIES

Youth in Agriculture
Agribusiness
Systems Research
Climate Change
Natural Resources Management
Impact and Outscaling

YOUTH IN AGRICULTURE

The IYA - Promoting Agriculture as a Viable Business Venture

IYA: PROMOTING AGRICULTURE AS A VIABLE BUSINESS VENTURE

By Adetola Aderonke and Evelyn Ohanwusi

Participants at the YADI conference. Photo by IITA

Agriculture suffers from entrenched negative perceptions among the African youth. In the minds of many young Africans, farming is poor man's work involving backbreaking labor in the fields and showing little for it. In 2011, a group of enterprising young individuals – the IITA Youth Agripreneurs (IYA) – decided to show that this could be different. Their mission: to make young Africans see that agriculture could be an exciting and economically rewarding business venture and to convince investors by showcasing their success stories.

FOSTERING THE ENTREPRENEURIAL SPIRIT

To boost continent-wide buy-in into the IYA concept, IITA and the Alliance for a Green Revolution in Africa (AGRA) organized a major conference *Youth Agribusiness Development Initiative* (YADI) at the IITA Headquarters in Ibadan, Nigeria in May. This resulted in a concept note for the establishment of a pan-African youth-in-agriculture program *Empowering Novel Agribusiness-Led Employment for Youth in Africa* – or ENABLE YOUTH. The program is envisioned to be a 5+-year initiative to be led by IITA with national, regional, and private sector partners in West, East, Central, and Southern Africa. The African Development Bank (AfDB) will fund the program.

ENABLE YOUTH will provide opportunities for young underemployed people, especially in the rural areas, to establish innovative agricultural enterprises, improve their agribusiness skills, create a conducive business environment by advancing youth-led policies, provide communication and other related service networks, and deliver needed agricultural information to others involved in agribusiness.

The IITA Youth Agripreneurs shows off banana plants grown in the greenhouse. Photo by IITA

At the *Agribusiness-led Employment for Youth in African Agriculture* side event of the African Union Commission-sponsored Agricultural Green Revolution Forum (AGRF) held in Addis Ababa, Ethiopia on 1-4 September, IYA representatives talked about ENABLE YOUTH and encouraged participants to support youth agribusiness in Africa.

Similarly, at the 15th Anniversary Celebration of the Forum for Agricultural Research in Africa (FARA) held in Johannesburg, South Africa, on 26-29 November, IYA members delivered a passionate plea to policymakers to support youth involvement youth in agriculture.
The Federal Government of Nigeria in 2014 cited IYA as the model for its national Youth Engagement in Agriculture Program (YEAP), part of the country's grand Agricultural Transformation Agenda.

IYA forged new ties in 2014 with several private and public institutions such as Chevron Nigeria Ltd, the Olusegun Obasanjo Presidential Library Youth Center (OOPLYC), the Federal Ministry of Agriculture and Rural Development (FMARD), Ekimiks Nigeria Ltd., and Durante Fish Industries Limited, to name a few. Other partnerships are also in the pipeline.

Since the launch of the IITA-Kalambo Youth Agripreneurs in Bukavu, DR Congo in 2013, similar initiatives have been initiated in Tanzania, Uganda, Zambia, and Kenya. The IYA concept has also been successfully replicated in Borno State, Nigeria.

IITA Youth Agripreneurs meet Nigerian President Goodluck Jonathan (left) and Agriculture Minister Akin Adesina (right). Photo by IITA

TRAINING AND MORE TRAINING

In 2014, IYA organized a 3-week intensive training for young people from Borno – a state in northeastern Nigeria badly hit by insurgency. The training, which was held at IITA's Kano Research Station, imparted knowledge and skills on the sustainable production of crops (groundnut, millet, sorghum, maize, and soybean), aquaculture, food and nutrition security, and agribusiness entrepreneurship to help the young participants cope with the effects of the insurgency. The training was supported by the N2Africa project.
IYA also trained another 20 youth from Cross River State on agribusiness and best-bet agronomic practices, and conducted training at the Ore Agribusiness City Ondo State, under the Wealth Creation Agency Program. Other training workshops facilitated by IYA included those on High Quality Cassava Flour (HQCF) and the Cassava Transformation Agenda (CTA), mostly in Nigeria's southwest region.

SPREADING THE WORD

In 2014, IYA recorded significant improvements in its awareness-raising initiatives using social media platforms such as Facebook, Twitter, blogs, and YouTube.

BOOMING BUSINESS

In 2014, IYA cultivated a total of 21 hectares of cassava at Osoogun and 25 hectares at Ido, and harvested 37 tons of cassava roots and 3,678 bundles of cassava stems from its fields at IITA-Ibadan and in Olokoto. Members also produced more than 4,100 banana suckers from the field and the macropropagation chamber at IITA-Ibadan. The group also diversified into the production and sale of cauliflower, okra, sweet corn, papaya, lettuce, spinach, cucumber, watermelon, and green beans.

Expanding its operations into northern Nigeria, IYA established eight 4-hectare fields of soybean in Mokwa and Zaria that yielded 7.9 tons of seeds. In Mokwa, Zaria, and Ibadan, IYA planted 23.3 hectares of maize

and harvested 54.6 tons. IYA also planted four hectares of cowpea in Zaria.

For value-addition, IYA introduced and promoted a new product-soy milk. To support this, IITA established a small-scale processing center for commercial production and sale.

IYA also diversified into fish and swine raising. In May, after a two-week intensive training on aquaculture at DuranteDurante Fish Industries Limited – one of Africa's largest fish companies – IYA started raising *Clarias*, a type of catfish. To kick-start the business, IYA stocked four ponds in the IITA-Ibadan campus with 20,000 fingerlings and established a modern fingerling hatchery. The group also started raising hogs for meat, starting with six sows/breeders and four piglets.

Youth Agripreneurs learn by doing: cutting cassava stems. Photo by IITA

Pamela Pali

PASIC Project
Coordinator, Uganda

I am coordinating the Policy Action for Sustainable Intensification of Ugandan Cropping systems (PASIC) project. We collect evidence to convince policy stakeholders and value chain actors on the need for intensification and to ensure that the evidence is included in the policy processes. We are also trying to influence the policy processes.

So far PASIC has made steady progress in creating strong partnerships with like-minded organizations to review and make recommendations on relevant policies. For example, we have reviewed the seed related policies and the recommendations we made will soon be submitted to the cabinet for further deliberation. I am finding it very intriguing to work with policymakers as they operate in a very different way from the way we researchers do. It has been challenging to penetrate, convince, and influence them on the need for crop intensification but indeed with persistence, we are making progress.

One of the notable things so far in my stay at IITA has been the level of interaction. These include my frequent interaction with the country representative to get feedback on my work and brainstorm important issues. I have also had the opportunity to interact with the Deputy Director General for corporate service and the board of IITA and hub directors when they visited Uganda in 2014. This shows the interest of the IITA leadership and top management in the country offices which is very motivating to the staff.

AGRIBUSINESS

The IITA BIP - Bridging Science and Private Sector

GoSeed - Seeding Africa's Future

NoduMax - Giving Legumes a Good Fix

Aflasafe - Safer Crops for a Healthier Future

IITA BIP - BRIDGING SCIENCE AND THE PRIVATE SECTOR

By Ken Dashiell and Shane Masters

The dictionary defines 'incubate' – as a verb – to mean "to develop; grow; take form" and "to develop or produce as if by hatching; give form." The word is usually associated when hens produce chicks. In a way, through our Business Incubation Platform (BIP), this is not a far-fetched description of what we do: we conceive ideas and technologies (the eggs); we then provide a favorable condition for their development (the incubation), and finally hatch them for the world to use and derive benefit.

Conceptually, the BIP will support IITA's strategic goals and accelerate the commercial development of IITA's proven and profitable R4D technologies. The BIP focuses on two avenues of commercial development: on the one hand, IITA's scientists create innovative products with the potential for commercialization. There must be a close alignment between the BIP – which will be best able to assess the needs and opportunities of the market – and IITA's R&D. On the other hand, as the BIP ramps up its services, it will initiate and build a network of public and private-sector partners that will support the activities of small to medium-scale agribusiness entrepreneurs, initially within Nigeria and, later on, elsewhere.

At the meeting of the IITA Board of Trustees (BoT) in May 2014, draft business plans of IITA BIP's initial start-up agribusinesses: GoSeed, NoduMax, and Aflasafe™ were given conditional approval and funding commitment to look at the feasibility of each business and the creation of the BIP. As a condition of the development of the BIP, the Board required the creation of an IITA BIP Advisory Council, which would provide guidance and oversight of the platform's establishment, operation, and feasibility of its financial performance. The functions, actions and roles of the BIP Advisory Council would be limited to making recommendations and providing relevant information for BoT decisions.

Aerial view of BIP facility. Photo by E. Koper, IITA

In 2014 the BIP Advisory Council was able to install a strong governance and oversight structure for the platform and guide IITA through the start-up process of developing one of the first sub-Saharan African agribusiness incubators within CGIAR. The feasibility review of the BIP and each of the start-up agribusinesses is ongoing and expected to be completed in 2015.

Members of the IITA BIP Advisory Council are Nteranya Sanginga (Advisory Council member, IITA BoT member, and IITA Director General); Hans Jöhr (Advisory Council Chairman and IITA BoT member); John Griffith (Advisory Council member and IITA BoT member); Lalitha Vaidyanathan (Advisory Council member and IITA BoT member); Kenton Dashiell (Advisory Council member and IITA Deputy Director General for Partnerships and Capacity Development); Prem Warrior (Advisory Council member); Jim Thaller (Advisory Council member and Interim IITA BIP Chief Executive Officer); and Shane Masters (Advisory Council Secretary).

GOSEED – SEEDING AFRICA'S FUTURE

By Baffour Asafo-Adjei

7460 Kg Breeder Seeds

As a business unit of the IITA Business Incubation Platform (BIP), GoSeed is charged with the production and marketing of quality breeder and foundation seeds/ planting materials of IITA mandate crops to private seed companies for production, distribution, and sale of quality certified seeds/planting materials to farmers. Awareness and use of quality seeds/planting materials of improved IITA maize, cowpea, soybean, and cassava varieties especially by smallholder farmers will expedite the improvement of their yields, livelihoods, and food and income security. GoSeed activities in 2014 were primarily focused on setting the stage for the full-scale production of breeder and foundation seeds in 2015.

GoSeed seed production activities involved the multiplication of fresh breeder seeds of five open-pollinated maize varieties; four rust resistant varieties of and two cowpea varieties. All are among the maize, soybean, and cowpea varieties most sought by farmers and seed companies in Nigeria. The rationale was to build the seed stocks of the varieties for the production of breeder and foundation seeds of the three crops during the main season of 2015 to meet the expected demand from private seed companies in Nigeria for the ultimate production of quality certified seeds in 2016.

Seed multiplication fields of parental lines of two maize hybrids that farmers and seed companies are excited about were also established at Kudu. In total, 7460 kg of breeder seeds of four maize varieties were produced and about 2000 kg will be used for the 2015 production of breeder and foundation seeds; 5460 kg are available for sale. Similarly, 1000 kg of breeder seeds of two cowpea varieties were produced and 800 kg will be used for 2015 seed production while 200 kg will be available for sale. The 1400 kg of breeder seeds of four soybean varieties will all be used for the 2015 production of breeder and foundation seeds. Additionally, the 6800 kg of maize foundation seeds and 2000 kg of soybean foundation seeds produced will be sold to seed companies (Table 1).

Table 1. Breeder and foundation seeds produced by GoSeed at Kudu in 2014.

Variety	Maturity / Color	Quantity (kg) of breeder seeds			Quantity (kg) of foundation seeds
		Produced in 2014	Required (for 2015 planting)	Available for sale in 2015	Available for sale in 2015
Maize					
Sammaz 15	Intermediate / White	4000	1000	3000	4000
Sammaz 16	Intermediate / White	1660	400	1260	2200
Sammaz 27	Early / White	900	300	600	500
Sammaz 29	Extra-early / White	0	-	-	100
Sammaz 35	Early / Yellow	900	300	600	0
Total Maize		**7460**	**2000**	**5460**	**6800**
Soybean					
TGx 1835-10E	Medium yellow	200	200	0	1000
TGx 1987-10F	Medium yellow	500	500	0	-
TGx 1987-62F	Medium yellow	500	500	0	1000
TGx 1951-3F	Medium yellow	200	200	0	-
Total Soybean		**1400**	**1400**	**0**	**2000**
Cowpea					
IT99K-573-1-1	Early / White	500	300	200	-
IT99K-573-2-1	Early / White	500	300	200	-
Total Cowpea		**1000**	**600**	**400**	**-**

Six row planter. Photo by IITA

At an estimated selling price of 1000 naira/kg ($5.02) for maize breeder seeds and 750 naira/kg ($3.77) for foundation seeds, it is expected that sales of about 5,460,000 naira ($ 27,437.19) from breeder seeds and 5,100,000 naira ($25,628.14) from foundation seeds will be realized. Also, 400,000 naira ($2010.05) will be realized from selling the 400 kg of cowpea breeder seeds and 1500 naira ($7.54) from selling 200 kg of soybean foundation seeds. Thus, the GoSeed Unit stands to earn about 12.46 million naira ($62,613.06) in breeder and foundation seed sales.

NODUMAX – GIVING LEGUMES A GOOD FIX

By Paul L. Woomer and Dianda Mahamadi

The NoduMax legume inoculant is a product that contains nitrogen-fixing rhizobia able to colonize the roots of soybean and literally transform the crop into a "biological factory" drawing valuable nitrogen from the atmosphere, improving both the crop and soil. The development of NoduMax as an enterprise within the IITA Business Incubation Platform (BIP) is indeed timely considering that soybean farmers in West Africa lack access to this product. The year 2014 was an ambitious one for NoduMax as it witnessed the completion of its factory within the BIP complex, several months of product development, adjustments to its production line, and the establishment of quality assurance, registration, and marketing activities.

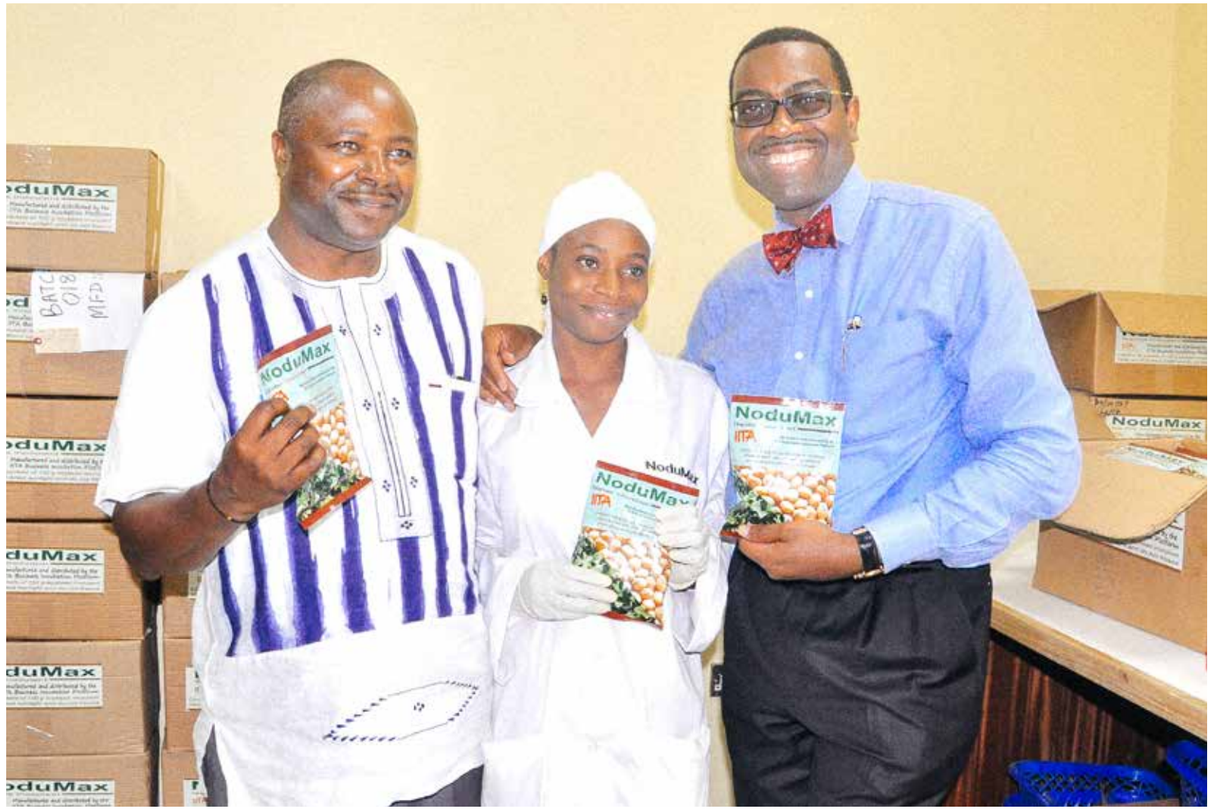
The NoduMax legume inoculant factory in IITA. Photo by IITA

Packing NoduMax at the BIP facility. Photo by IITA

COMPLETION OF THE NODUMAX FACTORY

The factory was designed and construction started in the latter part of 2013. The 240-m^2 design is based upon different steps and workstations of inoculant production: supply warehousing, carrier preparation, rhizobial broth production and mixing, curing to multiply and harden the rhizobia to withstand stress, product packing and storage, quality control, and marketing. Many of these workstations require different optimal temperatures and levels of sterility and this influenced factory design and construction features. Construction was completed in April 2014, allowing for the installation of factory equipment and initiation of NoduMax product development.

Quality control operations are conducted at the NoduMax factory for every production atch. Photo by IITA



IITA Director General with Nigerian Minister of Agriculture and Rural Development. Photo by IITA

PRODUCT DEVELOPMENT

Inoculant is typically produced by one of two basic approaches; bulk mixing followed by tray curing and carrier injection with curing in small bags. The former approach allows for ease in scaling up factory operations but exposes the product to potential contaminants; the latter is more controlled but labor-intensive. Both approaches were evaluated over several months and a combined production method was identified.

PRODUCTION APPROACH

Production of NoduMax inoculant involves the sterilization of a carrier material, mass rearing of rhizobia in broth culture, mixing the two together, curing the raw product to harden the rhizobia to stand environmental stresses, packaging the product along with a seed adhesive and detailed user instructions, and then boxing and storing the packaged product under cool conditions. The current carrier material is imported, finely ground peat that is gamma-irradiated for near complete sterility. The broth consists of *Bradyrhizobium japonicum* strain USDA 110, a widely recognized industry standard, raised in large flasks under filtered aeration. Broth is injected into large carrier bags, mixed and placed into racks in the temperature- and humidity-controlled curing room for many days. Once cured, the bags are portioned into 100-g packets for marketing. Each package of NoduMax is used to inoculate 10 to 15 kg of soybean seeds just before planting, so about six packets costing only US$15 are required per hectare. The factory is currently able to produce 800 packets daily but plans for increased broth production will raise that level to 1200 units daily.

AFLASAFE™ – SAFER CROPS FOR A HEALTHIER TOMORROW

By Ranajit Bandyopadhyay and Lawrence Kaptoge

Biological control is a natural, safe, and cost-effective scientific solution that drastically reduces aflatoxin contamination in maize and groundnut. The principles are based on crowding out aflatoxin-producing strains of Aspergillus flavus with carefully selected native strains of the same fungus that cannot produce aflatoxins. This biocontrol concept was developed by the United States Department of Agriculture's Agricultural Research Service (USDA-ARS). IITA and USDA-ARS designed a manufacturing process for Aflasafe™ using available off-the-shelf equipment that was different from that used elsewhere. The Meridian Institute, on behalf of the Partnership for Aflatoxin Control in Africa (PACA) (see related section "The Right Information in the Right Hands", page 36) and with resources from the Bill & Melinda Gates Foundation, funded the construction of a prototype manufacturing facility at IITA-Ibadan that can be used to produce Aflasafe™ to treat tens of thousands of hectares of smallholder farms. The demonstration manufacturing plant can also serve as a model that could be replicated in other countries affected by aflatoxin, where biocontrol research is already under way. As a critical component of the strategy, we focused on developing a system that can easily be transferred to private sector actors.

In 2014, we made significant progress in Nigeria on the registration, manufacture, and commercialization of Aflasafe™ which are prerequisites for access to and adoption of the highly effective technology for aflatoxin mitigation in Africa.

Practical aflasafe field application after training, Kafanchan. Photo by IITA

aflasafe™

The factory was commissioned for the functional production and quality control of Aflasafe™. We developed standard operating procedures (SOPs) for the manufacture of Aflasafe™ and ensured strict compliance in manufacturing the product for the 2014 season. Special emphasis was placed on quality control aspects during key steps of product manufacturing. Inspectors from the National Agency for Food and Drugs Administration and Control (NAFDAC) evaluated and approved the plant for production of Aflasafe™.

On 30 October 2014, NAFDAC granted full registration to Aflasafe™, making it the first commercial biopesticide registered outside the United States for aflatoxin management. The full registration now gives IITA the freedom to license the product and expand Aflasafe™ commercialization efforts for the benefit of Nigerian agriculture and public health.

In 2014, in partnership with national institutions and with support from other donors, the plant produced 135.4 t of Aflasafe™ for various activities in six countries. Being a new product, Aflasafe™ will require substantial investment in marketing and sales promotion. This is where the Business Incubation Platform (BIP) comes in as part of its menu of agribusiness-support services.

The establishment of the Aflasafe™ factory at the BIP Complex in IITA-Ibadan in 2014 attracted the attention of a number of important investors, partners, and supporters. Among these was Dr Akinwumi Adesina, Nigeria's Minister of Agriculture and Rural Development who pledged support in scaling up and commercializing Aflasafe™. Minister Adesina also approved the inclusion of Aflasafe™ in the government's subsidy program GES in 2015.

Training on practical aflasafe field application with Fantsuam foundation mostly women implemeneters. Photo by IITA

Shiferaw Feleke

Agricultural Economist
Tanzania

Since completing my PhD in 2006, I had been working in academic institutions in the USA. But my interest was to work in similar positions in Africa. I thought that IITA would be the best place to prove myself and make a difference.

Since joining IITA, I have been working on several exciting projects that are related to adoption and impact assessments of agricultural technologies. I am analyzing the adoption of improved cassava technologies developed by IITA and their impacts on the livelihoods of African farm households. I have been able to organize, analyze cassava adoption data collected from four countries: DRC, Tanzania, Sierra Leone, and Zambia.

I have also been collaborating with two universities in Ethiopia on an impact assessment project funded by the Norwegian Agency for Development Cooperation (NORAD). As part of the project's objective of enhancing the educational and research capacities of the two universities, I have been helping three MSc students to analyze household baseline data and synthesize manuscripts that will be submitted for publication. I have also collaborated with my colleagues in developing a research proposal on cassava adoption in Nigeria and funded by the Gates Foundation.

What I enjoy the most about my job is the fact that it is output-oriented than input-oriented. I also enjoy the collaborative spirit of colleagues.


aflasafe™

SYSTEMS RESEARCH

Unlocking the Potential of Smallholder Agriculture through Systems Research Innovation and R4D Platforms - Together We Grow

UNLOCKING THE POTENTIAL OF SMALLHOLDER AGRICULTURE THROUGH SYSTEMS RESEARCH

By Valerie Poire and Bernard Vanlauwe

Led by IITA, the CGIAR Research Program on Integrated Systems for the Humid Tropics (Humidtropics) is one of three systems research programs, that focuses on sustainable intensification of farming systems, including the improvement of social and ecological resilience, and the maintenance of ecosystem integrity within farming systems.

In 2014, Humidtropics looked at strengthening the systems research dimension in various research activities of CGIAR and other core partners. Key elements include the analysis of systems leading to the identification of entry points for interventions. Gender dimensions are studied and mainstreamed and options for institutional innovation and scaling analyzed. Instructional design approaches and traditional postgraduate research fellowships on systems research contributed to capacity building.

Fifteen projects were established in various action sites in Central America, Central Mekong, East and Central Africa, and West Africa to develop a network involving multi-CGIAR collaboration and local, national, and international institutions. These projects develop and test combinations of technical, market, governance, and policy options that could improve the livelihoods of smallholder farmers. These platform-driven projects are based on priorities identified through research-for-development (R4D) and innovation platforms (IP).

Partnerships and strategic alliances continue to be important mechanisms for moving forward.

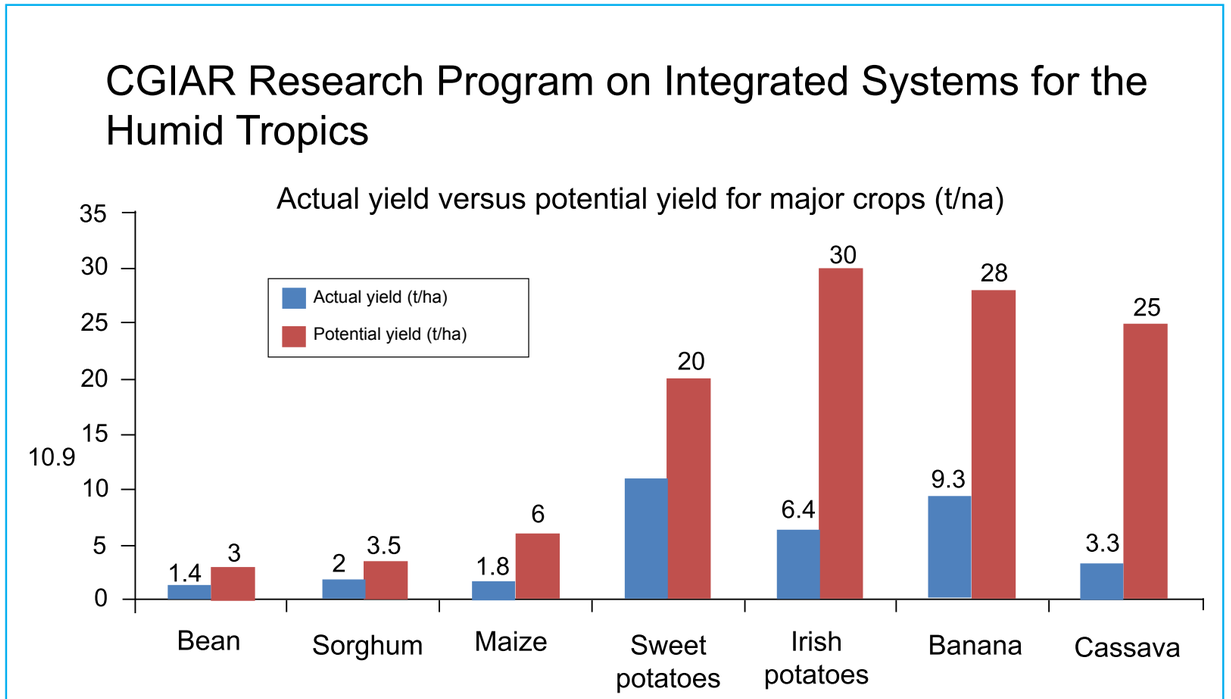


Figure 1. Yield of major crops in Rwanda. Source: Tuyisenge et al. 2013. Profitability of Major Food Crops in Rwanda, Policy Synthesis for the Ministry of Agriculture, RAB-Kigali, Rwanda.

SYSTEMS ANALYSIS AND SYNTHESES

Under this Strategic Research Theme (SRT), Humidtropics undertook two major activities in 2014: situation analysis and baseline surveys. The activities covered countries under the Consortium for Improving Agriculture-based Livelihoods in Central Africa (CIALCA) that included Rwanda, Burundi, and DR Congo (South Kivu). Baseline surveys have been completed with about 1500 households surveyed from over 130 villages.

Results show that the yields of major crops in Rwanda are below the potential by 43–87% (Fig. 1). The low yields may be attributed to low rates of adoption of improved technologies. In Rwanda, there is limited use

of fertilizers, pesticides, and improved crop varieties with an average of 20% of households using these inputs. In DRC, only 1% of households uses chemical fertilizer, 21% use organic inputs, and 3% use pesticides.

INTEGRATED SYSTEMS IMPROVEMENT

In the IITA-led Action Areas of East and Central Africa (ECA) and West Africa under the theme "Integrated Systems Improvement", Humidtropics conducted extensive rural appraisals to set research priorities that would address farmers' most severe constraints. In ECA, more efficient integration of trees, shrubs, crops, and livestock was the priority to increase crop production, improve nutrition, and arrest soil erosion. In West Africa, improved tree crop systems were identified as entry points, along with the intensification of cassava cropping systems and livestock integration.

In ECA, participating countries differed in the choice of crops, with highland banana being important in Uganda, potato in Rwanda, and cassava in DRC. The recently established IPs are implementing activities addressing the major constraints and opportunities in the region. In DRC, based on the limited availability of feed resources (Fig. 2), grasses are tested for fodder production and simultaneous erosion control. In Rwanda, agroforestry with alder (*Alnus acuminate)* was introduced for erosion control and as a source of stakes for climbing bean; this is part of a strategy to improve malnutrition resulting from the continuous monocropping of potato. In Burundi, pigs were introduced to improve income. Similarly in Uganda, the IPs are testing social and technological interventions for empowering women and the youth to improve income and nutritional status in crop-livestock systems of the Lake Victoria Crescent region. In Western Kenya the development and implementation of integrated soil fertility management for *Striga* control and enhanced system productivity are being tested.

In West Africa, cocoa was identified as a cross-cutting entry point. Research is under way in collaboration with the government of Osun State in Nigeria to identify cost-efficient technologies for cocoa establishment using degraded land and contributing to continued income and food production (Fig. 3).

Options identified by farmers to improve and optimize cassava systems, integrating legumes to enhance nutritional quality and maintain soil fertility, are being tested on-farm.

SCALING AND INSTITUTIONAL INNOVATION

To deepen knowledge of the importance and challenges in scaling and institutional innovation, Humidtropics held workshops on Rapid Appraisal of Agricultural Innovation Systems (RAAIS, Schut et al.

A farmer tending her improved cocoa plantation. Note the tree, although still small, is already bearing pods.
Photo by IITA

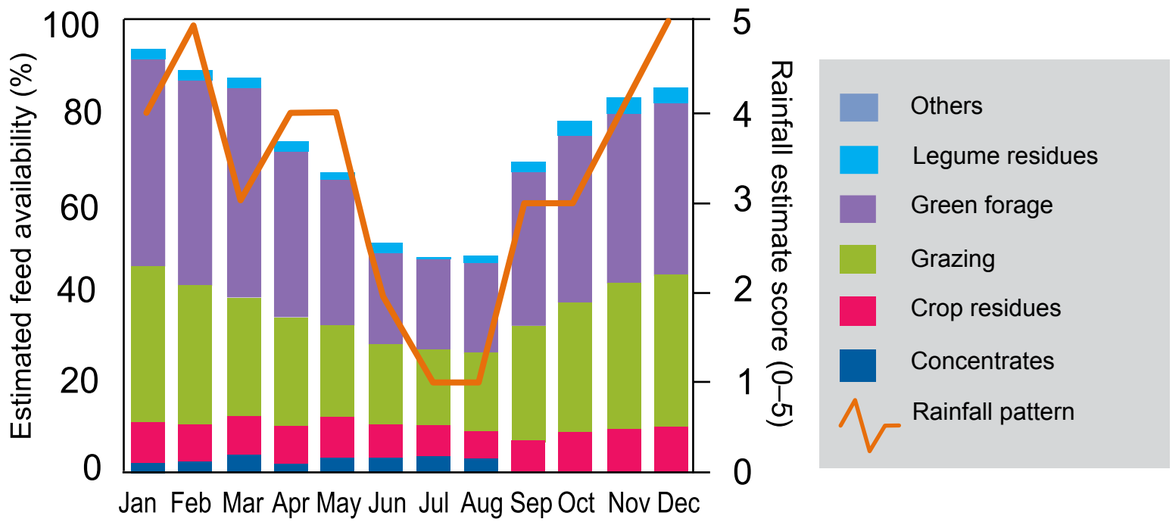


Figure 2. Feed resource availability in Walungu throughout the year assessed by the FEAST method (Duncan et al. 2012), from Bacigale et al. 2014.

2015) in Burundi, DR Congo, Rwanda, Cameroon, and Nigeria. The workshops aimed at identifying constraints and opportunities for technological and institutional innovation towards the sustainable intensification of agricultural systems across multiple countries. They showed that sustainable intensification required integrated productivity, natural resource management (NRM), and institutional innovations (Pretty et al., 2011) (Fig. 4).

Opportunities for institutional innovations were identified across seven countries and included structural stakeholder collaboration addressed in multi-stakeholder platforms and improved access to, and quality of, agricultural input, service, and credit systems. In Nigeria, for example, the Cocoa Research Institute (CRIN), in collaboration with IITA, the Forum for Agricultural Research in Africa, and other partner institutions, facilitated the timely availability of inputs for farmers, such as loans that are to be repaid after the first yields only.

To generate broader partnerships in integrated systems research, a Humidtropics Platform Fund (referred to as Cluster 4) was set up.

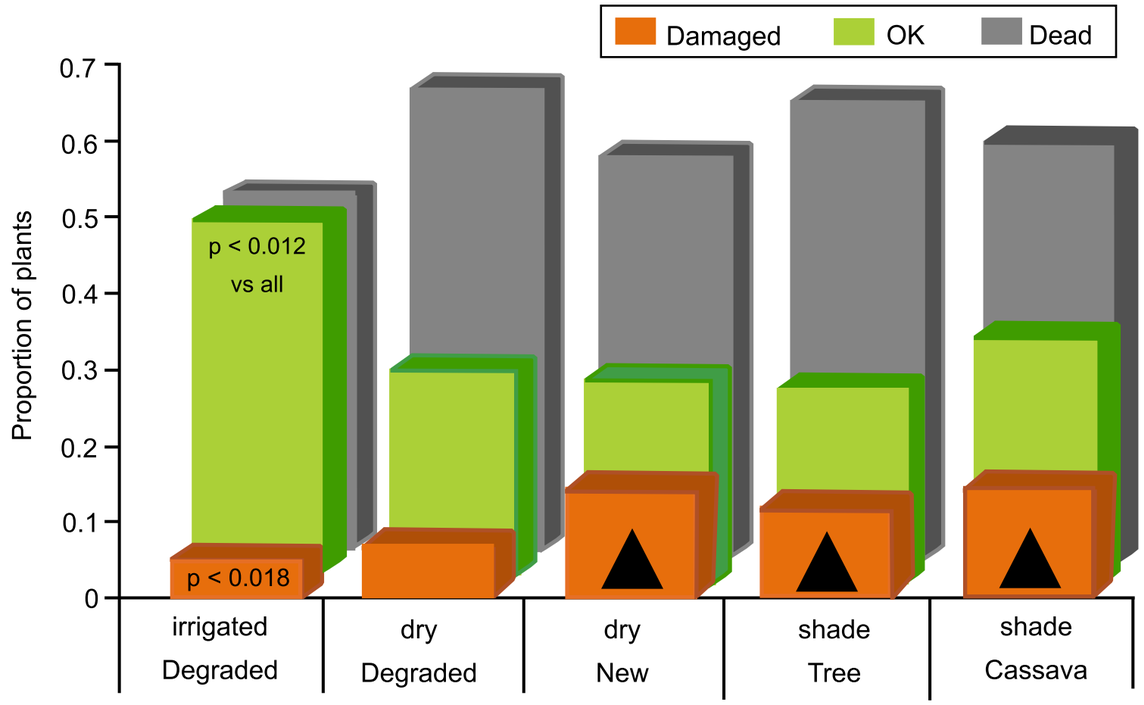


Figure 3. Proportion of dead, damaged and undamaged growing cocoa saplings 3 months into the long dry season, as a function of the soil quality shade and irrigation, at Ibadan, Nigeria.

Photo 2. A joint participatory diagnostic conducted by Côte d'Ivoire R4D platform in Soubre region, Côte d'Ivoire. Photo by Latifou Idrissou.

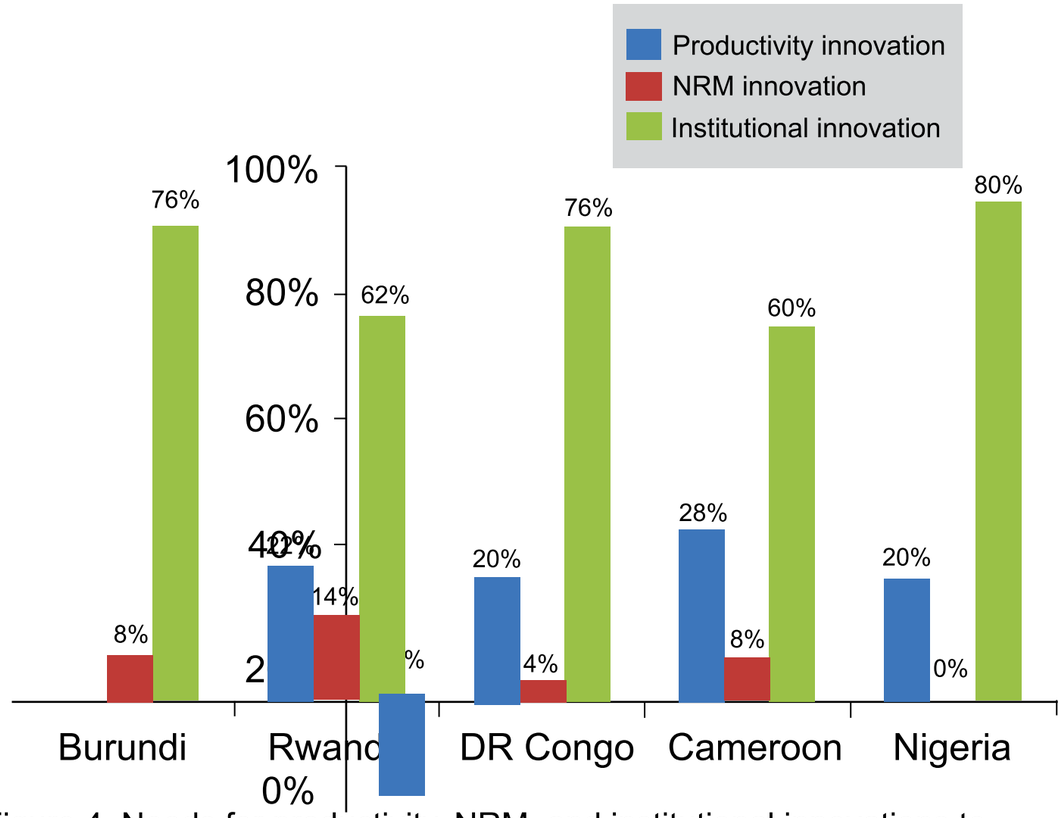


Figure 4. Needs for productivity, NRM, and institutional innovations to address stakeholder constraints related to sustainable intensification of agricultural systems in West and Central Africa.

This is a special supplementary fund to support the use of R4D and innovation platforms to identify problems and opportunities and prioritize issues, then test alternative social, economic, and technical system interventions that might improve the dominant agricultural systems in a particular Action Site. In East, Central and West Africa Flagships, Cluster 4 projects were developed by the platforms on best-bet improved productivity, markets, nutrition, and NRM interventions, among others. These are now undergoing validation through participatory action research.

Renee Bullock

Postdoc Researcher
Humidtropics, Kenya

As a gender researcher, it is my job to ensure that due consideration is given to the different ways in which individuals may experience constraints and opportunities to improve their lives.

This involves mainstreaming gender in our projects and activities and ensuring that we generate evidence to demonstrate how interventions may influence men, women, and youth differently and will contribute to IITA's potential to transform and improve lives. For example, a better understanding of why and how some women are excluded from technology design and development processes will inform our strategies on how to improve delivery and uptake. Targeted approaches to different segments of the population can ensure that improved technologies reach those who need them. These interventions, in combination with other targeted approaches, have the potential to transform gender relations and increase gender equitable outcomes.

I joined IITA because it is an outstanding institution working on agriculture and improving livelihoods in Africa. Since I started, I have been impressed by the energy, passion, and dedication that I see within our institution and partner organizations. Furthermore, my job provides opportunities to meet many people, whether in international conferences or in village-level community meetings. I have met talented and ambitious people who are committed to a vision of a better life that includes gender equity. This inspires me and fuels my commitment to continue working towards these goals in collaboration with others.

IP AND R4D PLATFORMS – TOGETHER WE GROW

By Marc Schut, Per Hillbur, Latifou Idrissou, and Chris Okafor

Several CGIAR Research Programs involving IITA have adopted the multi-stakeholder platform (MSPs) approach to achieve impact. Multi-stakeholder platforms are seen as a promising vehicle for agricultural innovation and development (van Paassen et al., 2014). They aim to foster technological and institutional innovation by facilitating continuous interaction and collaboration in networks of farmers, extension officers, policymakers, researchers, the private sector, and other relevant stakeholders in the agricultural system. MSPs provide space for learning and negotiation (Sumberg et al., 2013) that strengthen the 'capacity to innovate' in and across stakeholders' networks. They aim to stimulate collective agency and action, as well as processes that can lead to the responsible scaling of innovations.

The CGIAR Research Program on Integrated Systems for the Humid Tropics (Humidtropics) has adopted the MSP approach for achieving its research-for-development outcomes across three continents. Research-for-development platforms (R4DPs) operate at the regional level and are composed of different stakeholders' groups (e.g., farmers' networks, development organizations, the private sector, the government, and researchers) and scaling actors (politicians, donors, and the media). The innovation platforms (IPs) operate at the more local level, and stakeholders similar to those in the R4DPs are represented. By using participatory rapid appraisal tools (e.g., Schut et al., 2015), R4DPs and IPs identify entry points for integrated productivity, natural resource management (NRM), and institutional innovations to support sustainable intensification of agricultural systems (Vanlauwe et al., 2014). R4DPs seek to provide a more conducive environment for the IPs to implement their activities, and for successful innovations to go to scale.

Humidtropics Nigeria Team and Lagbedu IP members visit a cocoa farm in Lagbedu. Photo by Latifou Idrissou

Case studies from Nigeria, Burundi, and Tanzania provide a good overview of the successes, challenges, and opportunities for using MSP to achieve R4D impacts.

CATALYZING AN INNOVATIVE INPUT SUPPLY SYSTEM FOR NIGERIAN FARMERS

The Nigerian site covers the most important cocoa-producing region in the country. Within the cocoa

region, Humidtropics selected four field sites for starting IPs. The main constraints here are the unavailability of improved cocoa seedlings and the infestation of pests and diseases of cocoa plantations. Farmers lack timely access to improved cocoa seedlings and availability of appropriate fertilizers and chemicals. The IP members decided that the only way to solve this problem sustainably was to set up their own input supply system—including cocoa seedling production and distribution, and appropriate cocoa fertilizers and other inputs.

The Cocoa Research Institute of Nigeria (CRIN), an IP member, assisted in getting the job done. Input dealers represented in IPs were charged with making sure that fertilizers and other inputs needed by the IP farmers were available on time. Each IP produced a business plan submitted to the Forum for Agricultural Research in Africa (FARA). FARA agreed to provide a loan of US$10,000 to each of the IPs to start their activities.

Farmers are very enthusiastic about the activity. One cocoa farmer in the Akindele village explained: *"Every year we always wait for the government's inputs. This support will help us get improved seedlings to renew and even expand our cocoa plantations and chemicals to help us get rid of the pests that attack our cocoa trees."*

PIGS FOR INTEGRATED SYSTEMS IN THE CENTRAL HIGHLANDS OF BURUNDI

The Burundi R4DP and IP are implemented under the project Consortium for Improving Agriculture-based Livelihoods in Central Africa (CIALCA).

The IP decided to use the platform innovation fund to integrate a livestock component aimed at increasing the productivity of staple crops such as banana, legumes, cassava, and maize. Based on focus group discussions and surveys that highlighted farmers' constraints, pigs were chosen as the most feasible livestock option for the Gitega region. A group of 20 farmers already involved in the ongoing crop trials to facilitate the integration of crop-related R4D activities was identified to participate in initial experiments. Linked to the introduction of pigs, innovative multi-purpose fodder options were identified to address the challenge of animal feeding. For example, planting grasses (*Pennisetum*) provided good fodder on relatively little land while also helping to control soil erosion and providing mulch for banana plants.

TECHNOLOGY ADOPTION IN THE BABATI DISTRICT OF TANZANIA

Implemented under the Africa RISING project, the Tanzania Babati R4DP, locally known as *Jukwaa la Utafitikwa Maendeleo Babati (JUMBA)*, is now adopting new sustainable farming technologies. The platform stimulates learning and innovation by training farmers and extension staff in forage production and postharvest management. JUMBA has brought in the much needed organization to agricultural initiatives in Tanzania's Babati District. It has managed to rally stakeholders involved in agricultural development, developed a constitution that embodies its mission and vision, and developed a detailed plan of activities for the 2015/2016 cropping seasons. In addition, the platform has been able to nurture a sense of ownership and sustainability among important stakeholders within the District. For example, the Babati District Council as the key government unit has been so impressed by the value of the platform that it has pledged money to fund the platform's management and operations in 2016.

Here are some comments from IP members: *"I hope this platform can stimulate us to visit each other for knowledge sharing,"* said a woman during a recent R4DP meeting. *"We want transparency in the planning of research activities before they start, particularly the selection of farmers by extension agents.". "The platform can help in identifying markets and in learning how to access markets. It can also provide training for farmers to add value to their products so that they can increase their income," said* a private sector representative.

Humidtropics Burundi Facilitator Cyrille Hicintuka inspecting the piglets in Gitega. Photo by Dieuwke Lamers

Although many of the MSPs are relatively young, we can see how the participatory, demand-driven approach contributes to the development of coherent and integrated R4D strategies and to the development of strong multi-stakeholder partnerships, and to cross-CGIAR Center and CGIAR Research Program collaboration.

CLIMATE CHANGE

EAST AFRICA COFFEE - GETTING TOO HOT TO HANDLE

By Laurence Jassogne, Sandro Craparo, and Piet Van Asten

Do you know that rising night time temperatures might eventually lead to the disappearance of the world's favorite hangover cure and morning kick-start brew?

An IITA-led research has shown that elevated night time temperature is the most significant climatic variable responsible for diminishing Arabica coffee yields. The sensitive *Coffea arabica* berries need low temperatures to grow well and produce high-quality coffee, which is why they are best planted in the cool tropical highlands of East Africa, typically at altitudes of between 1300–2800 meters above sea level. The study shows that between 1961 and 2012 – as night time temperature rose an average of 1.47°C – mean *Arabica* coffee yields declined by about 46%, from 420 kg to 225 kg per hectare.

The research is the first of its kind in the world to offer concrete evidence that climate change presents a clear and present danger to coffee production. Long-term data on climate and *Arabica* coffee production, drawn from independent sources to quantify the impact of climate change on Tanzania's coffee exports, show that the country has lost about 20% of its export revenue due to a >1° C increase in the minimum temperature over the past 40 years.

The study also projects that an increase of even just 1°C in average night time temperature could potentially reduce coffee yields by almost 70%. And while studies like this, as well as models and maps relating climate change to coffee production have sparked a lot of talk and debate on the subject, there has been relatively little action by decision makers to come up with corresponding adaptation and mitigation strategies especially suited to smallholder growers who stand to lose the biggest.

The research, financed through the CGIAR Research Program on Climate Change, Agriculture and Food

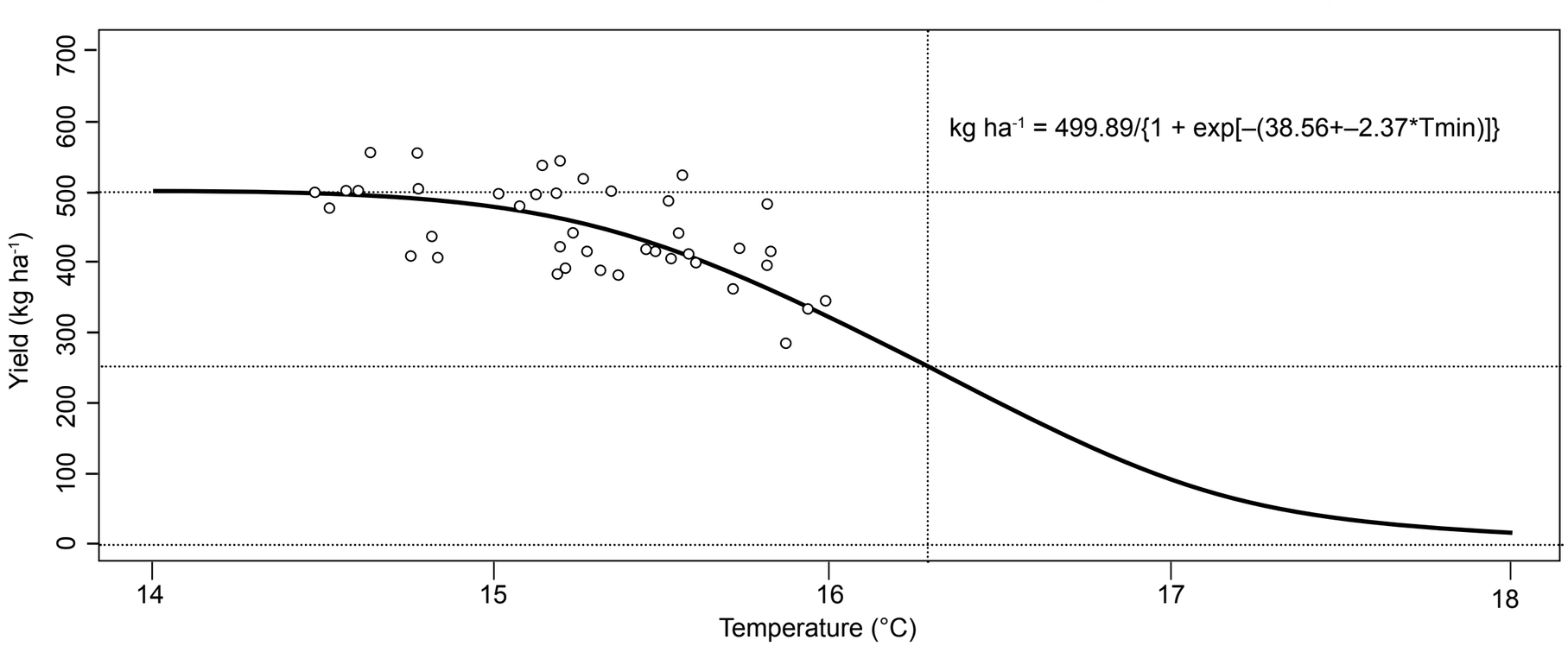


Figure 1. Non-linear model of *Arabica* coffee yield in northern Tanzania regressed by minimum temperature, extrapolated to 18°C.

Security with funds of the German Federal Ministry of Economic Cooperation and Development (BMZ), will give coffee sector players and decision makers the hard facts required to make informed decisions in investing in appropriate climate change adaptation strategies that will better sustain this important industry and the livelihoods of the millions of smallholder farmers who depend on the crop. The research will be published as a study in the first quarter 2015.

Additionally, our modeling projections show that the suitability of growing coffee on Mount Elgon at the Uganda-Kenya border will drastically change in the next 30 years if things continue as they are. At lower altitudes, coffee will not be a good livelihood option any longer as suitability will become marginal (red areas in Fig. 2). In this region, climate-smart agricultural practices such as shading in the mid-altitudes and sustainable intensification at higher elevations need to be put in place if this decline is to be stemmed or even reversed.

Climate change will have a direct effect not only on the suitability of coffee, but also on the crop's major pests and diseases. Related to this, another study led by IITA and in collaboration with CIAT, the University of Gottingen, the National Coffee Research Institute of Uganda (NACORI), and the Tanzania Coffee Research Institute (TACRI) has shown that not only are there influences at a macro-climate level, but that there are also interactions between systems within one climatic zone. Also, most climate-related yield losses are at mid-altitude (±1800 m) and are moving further upslope. Losses are also most prevalent in the coffee-open systems, but less in systems where trees or banana plants provide shade (Fig. 2). These findings must be taken into consideration when developing climate-smart practices in such systems and areas.

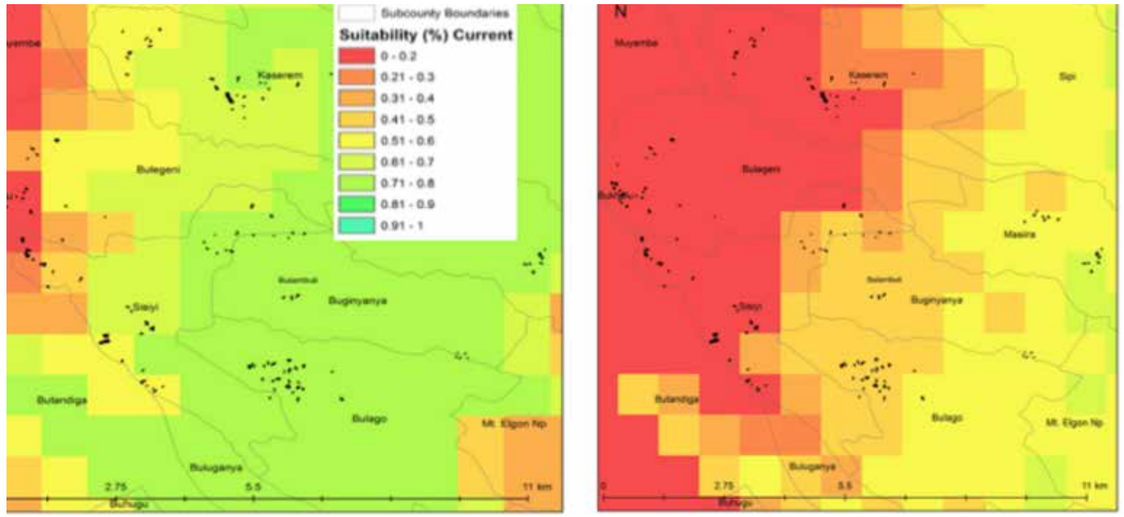


Figure 2. Current and projected suitability maps for coffee on Mt. Elgon. The small black dots represent coffee plots within the monitored areas.

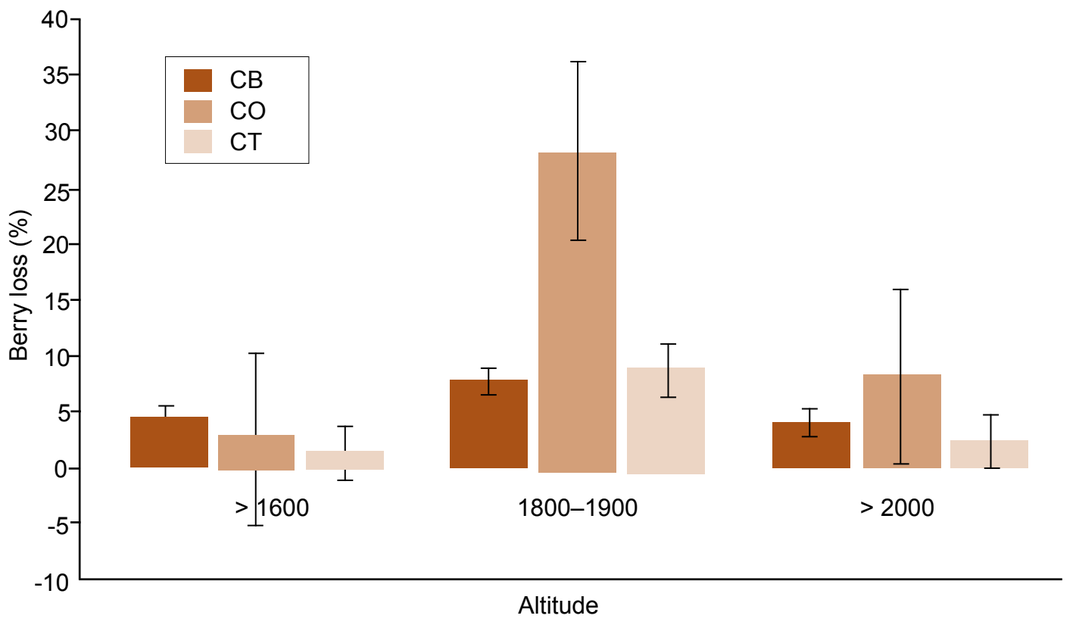


Figure 3. At mid and high altitude, yield losses due to berry borer are higher in coffee-open sun (CO) systems than in coffee-banana (CB) and coffee-shade tree (CT) systems.

AVERTING A CHOCOLATE MELTDOWN IN WEST AFRICA

By Sander Muilerman, Manuele Tamo, and Piet Van Asten

Demand for cocoa is increasing worldwide by 2-3% annually, particularly due to growing consumer demand in Asia. About 70% of the supply originates from West Africa where cocoa is produced primarily by smallholders with fields of less than 5 hectares. The smallholder yields are low (10-30% of potential) and highly variable with little use of external nutrient inputs. Traditionally, cocoa production relied largely on the expansion of growing areas into 'fresh' forest, driving deforestation.

With less than 15% of the original forest cover in West Africa remaining, the cocoa sector is increasingly concerned about the future of the crop and the forests, particularly since recent studies led by the International Center for Tropical Agriculture (CIAT) and supported by IITA revealed that climate change threatens the current production zones.

Over the past decades, many cocoa actors have promoted intensified monocrop systems. These systems are often perceived to have the highest production potential, but they do expose farmers to the risks of climate variability and reduced sustainability. Research from IITA, both past (e.g., Sustainable Tree Crops Progam - STCP, Alternative to Slash and Burn - ASB) and present (e.g., SNV-Netherland's cocoa-eco project and BMZ-funded project on cocoa/coffee systems and climate change) reveals that fertilizer use in West Africa is largely limited to areas where fallow land is no longer available and/or where government programs actively enhance access to external nutrient inputs. Based on

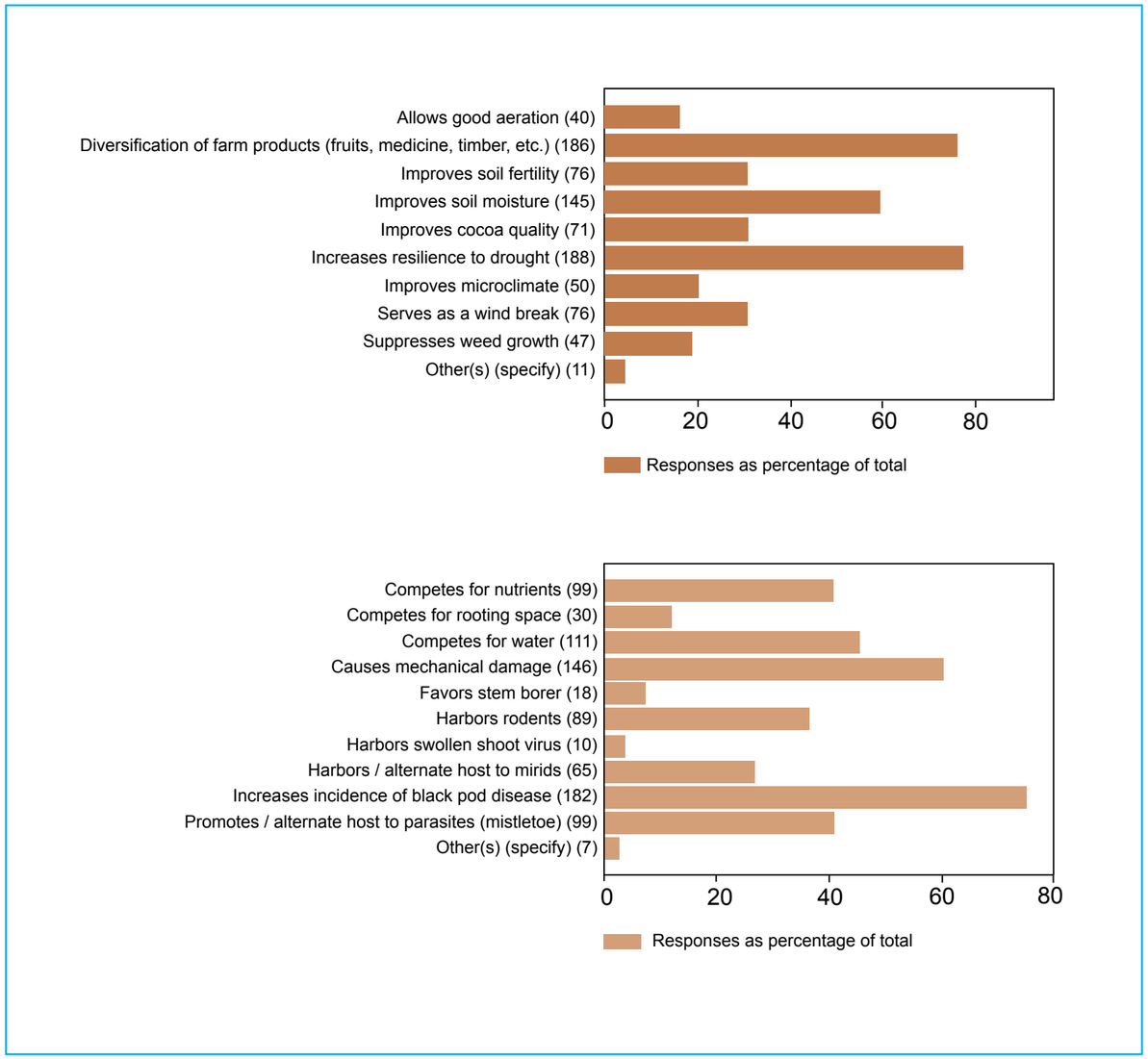


Figure 4. Farmers' perceptions of benefits and constraints of shade trees as a strategy for adapting to climate change.

this information, IITA, together with our partners, are developing practical climate-smart technologies for farmers, such as targeted and integrated soil nutrient management, shade trees, plantation rejuvenation, and innovative biocontrol.

In 2014, we developed novel approaches that link our research outputs to scaling partners. We are now reaching out to Kuapa Kokoo (Ghana's largest cocoa cooperative) and we actively engage in bringing climate-smart knowledge to the voluntary certification standards (Rainforest Alliance) and finance institutions (Root Capital) in collaboration with CIAT. In 2015, we'll further link these novel partnerships to Humidtropics (see related section on page 22) to help the next generation of cocoa farmers tackle the challenges related to climate change.

Photo: Engaging with smallholders to create mutual learning on how to improve cocoa systems. Photo by IITA

Murat Sartas

Visiting Innovation Systems Scientist, Bukavu, DRC

I joined IITA for two main reasons: first, I was impressed by the enthusiasm of the IITA teams especially in Uganda and Burundi, and their desire to have development impact. And secondly, IITA is led by a dynamic, friendly and visionary leader who inspires us and our partners.

I work on agricultural innovation systems, particularly looking into the effectiveness of the systems approach and multi-stakeholder processes in achieving development outcomes under the CGIAR Research Program on Integrated Systems for the Humid Tropics (Humidtropics). Systems research is important because technical solutions do not create development impact unless they are complemented with social, cultural solutions.

In addition, using a systems approach creates incentives for scientists to move out of their comfort zones and work not only on improving yields and increasing incomes but also decreasing negative environmental impacts, empowering women and youth, and building the capacity of other stakeholders to better coordinate and solve problems themselves. The research approaches and tools that I develop allow collaboration with different stakeholders which in turn leads to better understanding and management of the research-for-development (R4D) processes introduced by IITA. For example, by using simple and free tools such as Google, Dropbox, and WhatsApp we are able to facilitate better sharing of information and learning which not only assists the project to achieve its targets but empowers the project team and partners in the long term.

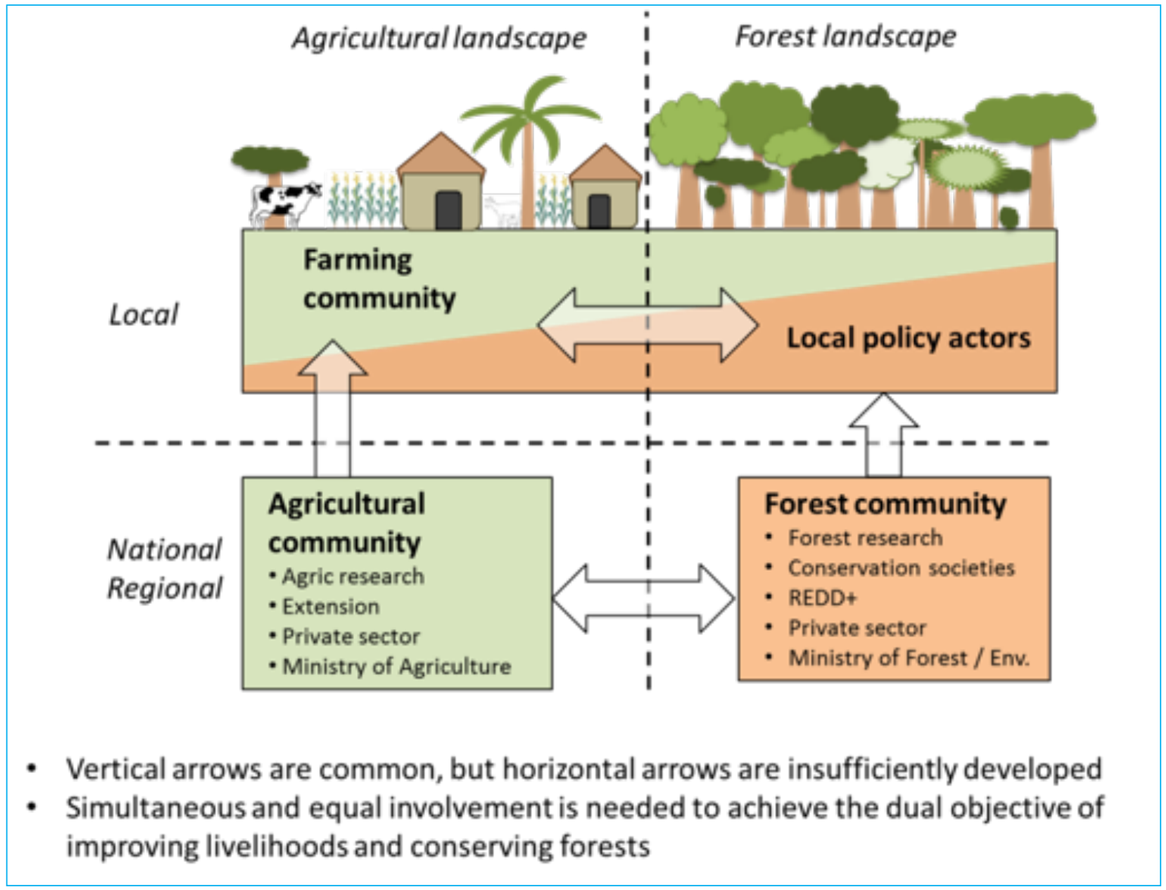
SAVING THE BASIN

By Rachid Hanna, Piet Van Asten, and Bernard Vanlauwe

Within the Congo Basin, pressure on forests has resulted deforestation or forest degradation. Intensification of agriculture in the forest margins associated with appropriate policy and regulatory frameworks can reduce such pressures (Maertens et al. 2006). Within IITA's natural resources management (NRM) research area, we have started engaging with conservation organizations and other development partners, such as the African Wildlife Foundation (AWF), Program for the Sustainable Management of Natural Resources (PSMNR), Southwest Region – Cameroon, and the Dutch Development Corporation (SNV), in intensifying the forest margins in the Congo Basin.

A workshop convened on 13 November 2014, in Kinshasa, Democratic Republic of Congo (DRC), found a general lack of cross-sectorial dialogue between forest and farming communities though each commonly engaged with its respective local policy actors. (Fig. 1). The workshop was organized by IITA in partnership with the Centre for International Forestry Research (CIFOR) and the International Food Policy Research Institute (IFPRI), and supported by the CGIAR Consortium Research Program on Climate Change, Agriculture and Food Security (CCAFS).

The following sections highlight areas where IITA, has engaged with various partners and stakeholders to promote sustainable agricultural intensification for forest conservation and climate change adaptation and mitigation within the context of promoting effective dialogue between the agricultural and the forest conservation communities.



DEVELOPMENT AND EXPANSION OF SUSTAINABLE AGRICULTURE

In March 2014 IITA and the African Wildlife Foundation entered into a strategic partnership to protect the ecological integrity of the Maringa-Lopori-Wamba Forest Landscape while intensifying agricultural productivity and increasing the income of local farming communities. The landscape is located in the Equateur Province of DR Congo and provides critical habitats for several threatened and endangered species including the bonobo and forest elephant.

Our specific R4D interventions consist of testing and validating high-yielding and pest and disease-resistant crop varieties through participatory variety selection with farmers, and demonstrating best agronomic

practices that are aligned to the forest conditions and soil management practices including improved fallows with local legumes.

Furthermore, gender dimensions have been integrated to refine the understanding of what works, where, and for whom and share best practices and lessons learnt equally with men and women. We are also enhancing enabling conditions such as access to inputs, opportunities for value addition and market facilitation, as well as capacity of farmers' associations in business management, best agronomic and soil management practices, new technologies for processing, and collective marketing.

CASSAVA AND PLANTAIN INTENSIFICATION

The objective of IITA's interventions in the framework of the Programme for Sustainable Management of Natural Resources in the South West Province of Cameroon (PSMNR) is to improve the livelihoods of households in villages around the Mount Cameroon National Park (MCNP) and of cassava around Korup and Takamenda National Parks (KNP and TNP) through e intensification of cassava and plantain production.

We established cassava multiplication plots in 25 villages in the three national parks to generate income for the multipliers and to facilitate the dissemination of new cassava varieties. The acceptance of these varieties was increased through participatory variety selection based on yield, earliest harvest, and quality. Similarly, 54 fields around MCNP were established for participatory evaluation of integrated pest and soil fertility management. Macropropagation facilities were also established in eight villages where farmers have been trained in this efficient technique of plantain multiplication. To date, 425 farmers have been trained in cassava multiplication and pest and disease management, six improved varieties have been selected, and more than 20,000 cassava cuttings have been distributed to farmers for further multiplication. A market information survey has been completed and the data are being analyzed with the eventual aim of targeting interventions.

Working with farmers in Djoulou, DR Congo. Photo by AG Kehbila, IITA-DRC

Gaya Ibrahim

Postdoc Gender Researcher, Humidtropics And Maize CRPs Nigeria

I joined IITA to actualize my childhood dream of wanting to see that all are treated equally regardless of who they are. I come from a community where women are treated very badly, with little respect, and no one to help. I still remember the stories my grandma used to tell me when I was a child of how her husband mistreated her. 'Worse than a slave,' she told me. I felt so bad then, and I still do. I swore that I would do something about it when I grew up.

I am working closely with the Programs' Gender Specialist and Flagship Managers to provide support for gender mainstreaming and strategic gender research activities. Gender relations are a key aspect of the real-life contexts that agricultural technologies are deployed. They affect what results can be achieved, how, and for whom.

In essence, under these CGIAR Research Programs, I work to help bring about a gender-responsive agricultural research and development system to address women and men as distinct clients and actors in agricultural research.

A plantain baseline survey highlighted the importance of pests and diseases and the low plantain yields, despite the relatively good soil fertility in the area around the MCNP. In August/September 2014, 56 demonstration plots were established in eight villages with over 5,000 tissue culture plants of local and improved plantain varieties along with the use of *Tithonia* mulching and mass trapping of banana weevils as integrated pest and soil fertility options.

Information on improvement in cassava and plantain productivity will be used by PSMNR to determine the impact of intensification efforts on the protection of forests and their resources in the three national parks.

FACILITATING THE DEVELOPMENT OF INTENSIFIED AND CLIMATE-SMART COCOA PRODUCTION SYSTEMS

Cocoa is an important cash crop in Cameroon, the fourth largest producer in Africa (0.22 million tonnes or 5% of the world's production). Much of Cameroon's cocoa is produced under traditional agroforestry systems (i.e., cocoa is inter-planted in remaining original forest and with fruit trees and food crops) and productivity and profitability are notoriously low due to the lack of improved varieties, poor pest and soil fertility management and postharvest practices, aging plantations, and the low levels of farmers' organization.

IITA and SNV entered into a partnership in 2014 to enhance cocoa productivity and profitability with innovations that include intensification, diversification and rejuvenation of cocoa plantations. We are supporting cocoa cooperatives to enhance the leadership of women, including training to encourage their participation in strategic positions in cooperatives and niches important to market linkages and promoting intergenerational dialogue for the use in cocoa farm succession planning.

The program builds on the experience, knowledge, and tools of IITA's former Sustainable Tree Crops Program (STCP), especially its award-winning Farmer Field School (FFS) curricula in integrated pest management, cocoa farm rejuvenation and diversification, biodiversity and occupational health and safety. We are bringing improved varieties directly to the farm through FFS or through the establishment of seed gardens of grafted improved hybrids. We are also developing new approaches for pest and disease management based on biological and behavioral tools. These include cocoa farm investment planning, rehabilitation options and strategies for more cocoa and more carbon stock in cocoa agroforestry, cocoa succession planning, recommendations from Reducing Emissions from Deforestation and Forest Degradation (REDD+), and best-bet climate change adaptation and mitigation.

ACKNOWLEDGEMENT

The authors thank the following for their invaluable contributions in the completion of this report: AG Kehbila, WTata-Hangy, N Mahungu, and WBiponda of IITA-DRC, Kinshasa; R Hanna, H Kirscht, AFKuate, and M Yemefack of IITA-Cameroon; and R. Chibikom, J. Lienou, N. Ewane, and A. Kamga.

Cocoa Farmer Field School demonstration in Konye, Cameroon. Photo by IITA

Fred Kanampiu
N2Africa-Kenya
Coordinator

"At IITA, I provide overall guidance and coordination for the N2Africa project which is working in 11 sub-Saharan African (SSA) countries. I was attracted to IITA because of its focus on taking research to scale and its responsiveness to the plight of African farmers. I can also say, it is a centre with a human face," says Fred Kanampiu, N2Africa Coordinator based in Nairobi, Kenya.

"The N2Africa project is a multi-partner project that is addressing issues that are critical to the agriculture sector in SSA. These include soil fertility, linking farmers to markets for inputs and produce, and food and nutritional security. The project promotes the production of legumes, which in addition to being a cheap source of protein and enriching diets, also fixes nitrogen into the soils thus improving soil fertility."

"We particularly work to empower women and the youth through supporting them to identify and tap into business opportunities along legume value chains. We also bring science to work for smallholder farmers by empowering them to adopt new technologies, enhance their productivity, and link them to markets."

"N2Africa won the 2014 World Bank Nutrition Award for its effort in scaling out technologies that promote better nutrition in SSA. I can say I truly enjoy working in N2Africa because it has a very committed team and a responsive, committed, and supportive IITA management leadership."

HOTTER CLIMATE MAKING INSECTS GO BONKERS?

By Hanna Rachid, James Legg, and Piet Van Asten

Crop insects and mites are tiny organisms that cannot regulate their own body temperature. Therefore, rising temperatures brought about by climate change are likely to have a strong effect on their functions and behaviors.

"there will be a general decline of all the insect species"

To determine the impact of a hotter climate on – and consequent reaction of – insect or mite species of important crops in Africa, IITA researchers in Cameroon, in collaboration with colleagues at the International Potato Center (CIP) and the International Center for Insect Physiology and Ecology (*icipe*), developed phenology and risk models for six important crop insect species in the continent. These included the cassava mealybug and the cassava green mite (both pests of cassava), the predatory mite *Typhlodormalus aripo* (the principal biocontrol agent of the cassava green mite), the fruit fly *Bactrocera invadens* and its parasitic wasp *Fopius arisanus*, and the banana aphid (the principal vector of the Banana Bunchy Top Virus). The research was undertaken with funding from the German Government (BMZ).

The phenology and risk models projected that there will be a general decline of all the insect species covered by the study in West Africa, with an expansion of range and a higher growth potential in southern Africa as well as in the highlands of Eastern, Central, and Western Africa. The models also showed that rising temperatures will have a higher negative effect on biological control agents, particularly in Western Africa. This situation will likely decouple the relationship between the insect pests and their biological control agents as the latter tend to be more sensitive to changes at higher temperatures than the former. These changes could have significant implications on existing and future biocontrol programs such as those for the cassava green mite and the cassava mealybug.

The full models of the six species under study, along with those of at least 12 other insect and mite species, will be published in 2015 in *Pest Distribution and Risk Atlas for Africa: Potential global and regional distribution and abundance of agricultural and horticultural pests and associated biocontrol agents under current and future climates*. This atlas will provide the first comprehensive predictions of climate-change risks of food crop pests and their biocontrol agents at global and local scales that can be used for climate-change adaptation planning.

Therese Ampadu-Boakye
Monitoring and Evaluation Specialist, N2Africa

"I have a passion for agriculture and its potential to address challenges with malnutrition and poverty across sub-Saharan Africa. I had worked extensively in Ghana and parts of West Africa in implementing agricultural projects leveraging value chain principles. Therefore, joining IITA provided a platform to further test my knowledge and expertise in a wider and more challenging geography – 11 countries in Africa, six of them in East Africa. It was also a chance to join a top notch global research institute focused on providing innovative and cutting-edge solutions to nourish Africa," says Therese Ampadu-Boakye, Monitoring and Evaluation (M&E) Specialist for N2Africa based in Nairobi, Kenya.

"Over the past year, I have developed an M&E system including a revised Theory of Change and results framework for N2Africa. I have helped developed data collection tools and processes. I have also supported training for partners in selected countries and helped them implement the data collection tools."

"What I like best about my job is the responsibility of interacting with project staff, partners and beneficiaries at different levels of the project and at IITA as an organization. I enjoy talking with people and my job allows me to do this every day. With the project, I look out for results and make sure that as a team, we keep our eyes on the ball."

THE RIGHT INFORMATION IN THE RIGHT HANDS

By Edidah Ampaire, and Tahirou Abdoulaye, and Piet Van Asten

Establishing and understanding existing knowledge, perceptions, and beliefs is the first logical step in designing any strategy. On the issue of agriculture in climate change, knowing what farmers know, believe, and perceive are vital prerequisites for key actors and decision makers to develop and implement relevant climate change mitigation and adaptation strategies that farmers will accept and apply.

In 2014, we carried out a survey in Ghana to understand farmers' perceptions of climate change and their adaptation strategies. The survey involved 750 farm households in the Brong Ahafo and Upper West regions of the country and using a multistage sampling method. The survey was supported by the CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS),

Results showed that about 92% of the farmers surveyed are aware of climate change. Human, natural, and spiritual causes were thought to be the causes, with a majority of the households attributing it to deforestation (92.6%) and indiscriminate bush burning (88%). Most of the farmers (70.8%) obtained information on climate change through personal observations. With regard to farming adaptation strategies, the farmers listed the following as their top options: different crops/mixed cropping (39.6%), changing planting dates (21.4%), use of drought/early maturing crop varieties (17.4%).

Although the use of drought-tolerant maize (DTM) and early maturing varieties only figured third in the list, it was the second most important strategy used in the more drought-prone area of the Upper West. Overall, about 63% of the farmers claimed to have been affected by drought – 54.4% in Brong Ahafo and 80.7% in Upper West.

The rate of adoption of improved varieties was relatively high. The adoption rate was 60.2% in the Brong Ahafo region and 95.8% in the Upper West. For the entire study area, adoption rate was at 71.9%, which is above the national average. However, the estimated rate of adoption of DTM varieties was 36.2% in Brong Ahafo, 61.5% in Upper West, and 45% in the whole study area. The farmers cited household size, distance to input market, farm size, agroecological zone, perception of drought effect, livestock assets, and membership in associations or cooperatives as the main influencing factors in adopting DTM varieties.

Direct engagement with decision makers and policy actors is essential if any of our climate change research is to achieve practical impact at scale. With funding from the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), we are leading the Policy Action for Climate Change Adaptation (PACCA), a multi-Center CGIAR effort that aims to improve the policy environment in which smallholders operate by understanding the existing gaps. We are partnering with the International Center for Tropical Agriculture (CIAT), the International Livestock Research Institute (ILRI), the World Agroforestry Center (ICRAF), and Bioversity International in this initiative.

Working directly with the relevant government bodies in Tanzania and Uganda, the PACCA project takes IITA's climate change research from the field and communities to the offices of key policy actors. In Uganda, the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) has already started on a PACCA-supported process of developing climate change mainstreaming guidelines for the agricultural sector. Our approach has generated great interest within the donor community. USAID, through its Enabling Environment for Agriculture (EEA) program, and the FAO, for example, have expressed keen interest in supporting the process by shifting focus beyond climate change adaptation to include mitigation, thus greatly improving the opportunities for mainstreaming climate change guidelines developed with the help of our research.

NATURAL RESOURCES MANAGEMENT

Investing in Soils

INVESTING IN SOILS

By Bernard Vanlauwe, Fred Kanampiu, and Cargele Masso

As outlined in our Refreshed Institutional Strategy 2012-2020, one of our missions is to redirect over 7.5 million hectares of underutilized, marginal, and degraded lands to more productive and sustainable use. This attests to the invaluable role that land – the soil – plays in reducing poverty and improving the lives of the people that we serve – the farmers – in Africa. As a research-for-development organization, we carry out this mission through a variety of natural resource management (NRM) initiatives. We highlight two of our NRM projects that are addressing challenges related to soils: Putting Nitrogen Fixation to Work for Smallholder Farmers in Africa (N2Africa) Phase II, and Commercial Products (COMPRO-II) also now in its second phase.

"redirect over 7.5 million hectares of underutilized, marginal, and degraded lands to more productive and sustainable use"

ADVANCES IN RHIZOBIOLOGY RESEARCH

Rhizobia are nitrogen (N)-fixing soil bacteria that form nodules on the roots of leguminous plants. They belong to more than 120 species and differ in their host specificity and N-fixing efficiency in symbiosis with target legumes. The specificity of the legume-rhizobium symbiosis gives an ample opportunity for the selection of combinations of rhizobium × legume species/varieties to maximize the fixation of N from the atmosphere. Once effective strains have been identified, appropriate carrier material is impregnated, and prepared into inoculants that are applied to legume seeds at planting. This process, from the identification of elite strains to the preparation of the inoculants, requires microbiological procedures and technical know-how to apply the technology in field conditions. One of the areas on which N2Africa and COMPRO-II are working is to develop a set of standardized protocols for the collection, evaluation, and quality control of rhizobium strains.

We are working on ways to increase the quality of inoculant products and continue to characterize elite rhizobium strains for effectiveness in N2 fixation. Screening of the existing national collections for symbiotic effectiveness and exploration for additional new collections for common bean, soybean, chickpea, groundnut, cowpea, and faba bean are under way in collaboration with national institutions. In Tanzania, the project is collaborating with national research institutions to evaluate three commercial bean inoculants. The testing of rhizobia is also continuing in countries under Phase 1 of the N2Africa project. In Mozambique, N2Africa is collaborating with the USAID Platform to evaluate several commercial inoculant products and with EMBRAPA to evaluate four Brazilian rhizobium strains and co-inoculation with mycorrhiza.

The NoduMax plant at IITA Ibadan, Nigeria (see related section on the IITA Business Incubation Platform, page 20) is charged to produce and market quality grain legume inoculant for soybean in Nigeria. The first batches of the NoduMax inoculant have been produced and packaged, with labeling that conforms with international standards.

Packing of NoduMax that conforms to international standards. Photo by IITA

BEST-FIT AND BEST-BET AGRONOMIC OPTIONS

N2Africa has established a number of trials to determine which legume technologies work where, why, and for whom. The aim is to tap the abilities of these technologies to improve soils through N-fixation while also improving the nutrition and income of smallholder farmers. These include diagnostic trials to understand the biotic and abiotic constraints to legume production; demonstration trials that are co-run by scientists and farming communities to evaluate a portfolio of best-bet options within best cropping systems; and adaptation trials that evaluate how individual farming households adapt selected best-bet options and how farmers' management practices and environmental factors affect their performance. This last step also provides the framework for translating best-bet options to best-fit options.

In Uganda, groundnut responded significantly (SED=109, $P<0.01$) to the application of nutrient inputs (Fig. 1). On average, dry pod yield responses above the control were 23% for gypsum, 63% for triple superphosphate (TSP), and 52% for gypsum + TSP. Although these findings generally showed the highest response by groundnut to P fertilization, other soil constraints limited the responses to the applied nutrient inputs. These are to be characterized to aid the development of appropriate nutrient management packages to close the yield gap of groundnut.

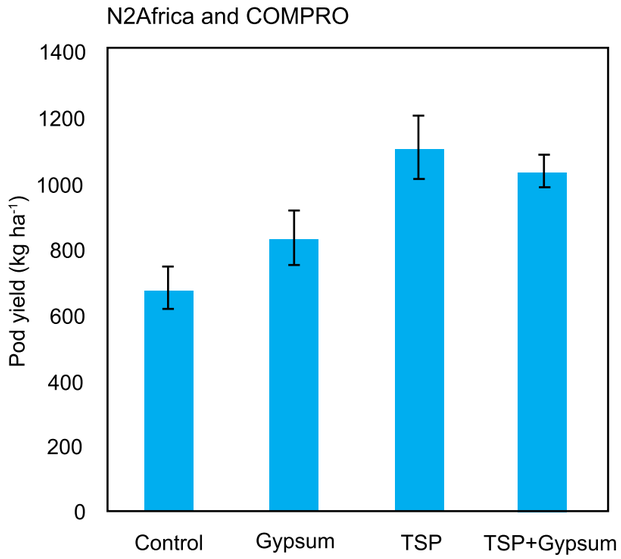


Figure 1. Groundnut yield response to gypsum and TSP in northern Uganda (n=10 demonstrations).

Trials by N2Africa in DR Congo that investigated the response of soybean to inputs (control, phosphorus, inoculation, and phosphorus + inoculation) highlighted the benefits of inoculation and phosphorus fertilizer on legume growth and nodulation (see photos). Complementary application of inoculants with P fertilizers is necessary to enhance growth and N-fixation.

TACKLING REGULATORY ISSUES OF INOCULANTS

Before the intervention of COMPRO-II and N2Africa, the

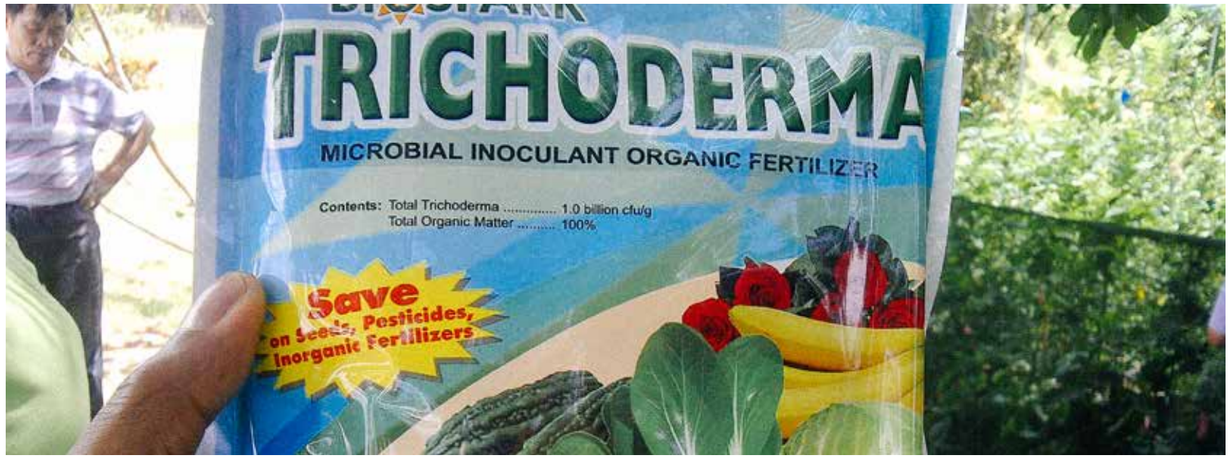
Demonstration trials in DR Congo highlight the benefits of inoculation and P fertilizer on legume growth and nodulation [control = no phosphorus or inoculant added; +Pfert = Phosphorus added; +ino = Inoculant added; +Pfert+ino = both phosphorus and inoculant added].

regulatory frameworks for biofertilizers (e.g., rhizobium inoculants) and biopesticides were weak in the countries where the two projects work. However, in less than 3 years, IITA, with the support of key partners, has reversed the situation (Table 1).

Table 1. Status of the regulatory frameworks for bio-fertilizers and bio-pesticides in the N2Africa and COMPRO-II countries

	Tanzania	Uganda	Ghana	Kenya	Ethiopia	Nigeria
Before COMPRO-II & N2Africa						
Status of biofertilizers regulatory framework	None	None	None	Active	None	Weak
Status of biopesticides regulatory framework	Dormant	None	(Weak)	Active	None	None
After <3 years of COMPRO-II and N2Africa (since 2012)						
Status of biofertilizers regulatory framework	Active	Dormant	Active	Active	Dormant	Active
Status of biopesticides regulatory framework	Active	Dormant	Active	Active	Dormant	Active

Currently, registration guidelines that relate to quality, efficacy, safety, and labeling have been finalized in four (Ghana, Kenya, Nigeria, and Tanzania) out of the six project countries. The regulatory bodies in these countries have started using these guidelines for product registration and products have since then been approved for legal sale and scaling up. Standard operational procedures for quality control are also available in the relevant laboratories. For instance, claims such as the guaranteed minimum analysis and saving on seeds, pesticides, and inorganic fertilizers for microbial products should be demonstrated before approval on a commercial label (photo at right).



Example of label claims to be demonstrated before inoculant registration. Photo by IITA

A similar process is ongoing in the two other countries, Ethiopia and Uganda. For sustainability, the guidelines include provisions for a customer-paid service for quality control and efficacy testing. Discussions on the harmonization of the requirements and equivalence of data have started to ensure consumer protection while facilitating transboundary trade. Equally important, IITA has helped to build the human and infrastructure capacity for quality control in the project countries. In Ghana, Kenya, and Nigeria, we have trained 89 national system staff in marketplace monitoring for conformity verification.

DISSEMINATION OF N2AFRICA AND COMPRO PRODUCTS

COMPRO-II and N2Africa have developed effective partnerships to scale up profitable technologies in DR Congo, Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Tanzania, Uganda, and Zimbabwe where development partners have reached out to thousands of smallholder farmers. The projects, particularly N2Africa, are also using field days, radio, video, posters, flyers,

COMPRO-II field day. Photo by IITA

leaflets, TV broadcasts, legume processing workshops, and farmer training events to increase the outreach. From their testimonies, over 70% of farmers plan to adopt the technologies once they are made available locally. In this regard, N2Africa has started to build the capacity of local agrodealers and explore ways to connect them with grassroots producers and input wholesalers or manufacturers. For instance in Kenya, "last-mile" delivery of agro-inputs is already under way with the establishment of 13 one-stop biological nitrogen fixation (BNF) technology shops, as well as an agrodealer network for marketing essential inputs.

INVESTING IN PUBLIC-PRIVATE PARTNERSHIPS FOR TECHNOLOGY DISSEMINATION

Both N2Africa and COMPRO are pursuing public-private partnerships (PPPs) as an implementation strategy. The PPPs are focused on the four major pillars: input supply, dissemination of technologies, market access, and capacity building. Partners engaged in such PPPs include development partners, NGOs, private organizations, and research organizations. Some major activities implemented through these PPPs include the dissemination of technologies to farmers via demonstration and adaptation trials, organization of field days for value chain actors, media events using radio and TV broadcasts, legume processing workshops, and farmer training events.

PPPs focus on the aggregation of production from farmers and demand from buyers for a longer period, allowing for a step by step approach in addressing the challenges faced by smallholder farmers. Through aggregating production and purchasing agreements, other essential parts of the value chain, such as loans/inputs, extension services and

Women sorting soybean grain before processing into milk during an N2Africa training of women on household level soybean processing in Ngororero district, Rwanda. Photo by Kantengwa Speciose, IITA.

Jonathan Odhong

Research Communications Specialist, Africa Rising

"I was drawn to IITA by its track record of producing award-winning and life-changing agricultural technologies for farmers in Africa. As a research communications specialist, I get to play a role in changing the stories of smallholder African farmers from that of food insecurity and poverty to one of food secure families with better nutrition and income security," says Jonathan Odhong, who works under Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program based in Ibadan, Nigeria.

"I work for the Africa RISING program, which comprises of three research-for-development projects supported by the USAID's Feed-the-Future Initiative. IITA leads two of the three projects: one in the Guinea and Sudano Savannah Zone of West Africa, and the other in East and Southern Africa. "
"Through this project, we are working to create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security. "

"Working in a program with over 200 scientists drawn from various institutions is an interesting experience. This diversity, of course, also presents some challenges based on cultural and organizational differences. However, I see this more as an opportunity to find innovative ways harness this diversity productively, especially on the communications side of things within the program."

crop insurance, can be unlocked. Within the framework of a multi-actor demand platform, this combined demand will address both market constraints and common issues encountered by smallholder farmers, such as access to finance and markets. In Tanzania, consultation meetings with potential PPP partners about beans have been undertaken under the World Food Program (WFP) to draft a road map. Support to farmers to produce a marketable surplus of beans and identification of collection points continue in northern Tanzania.

ACKNOWLEDGEMENT

The authors wish to thank the following for their contributions to this report: Theresa Ampadu-Boakye, Dianda Mahamadi, Alote Ewinyu, Moses Thuita, Abdelaziz Abdelgadir, Freddy Baijukya, Edward Baars, Peter Ebanyat, Emmanuel Sangodele, and Endalkachew Wolde-Meskel.

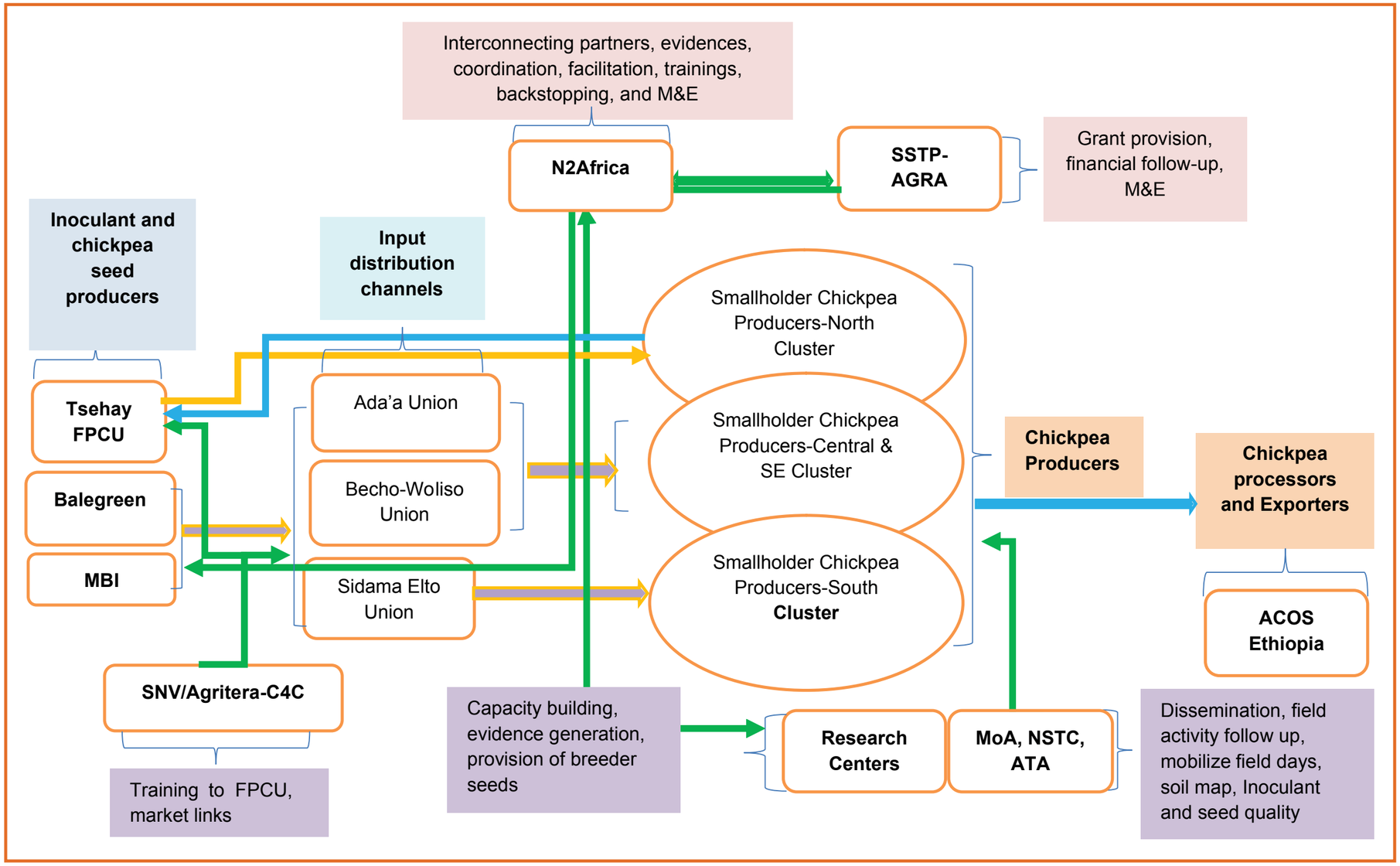


Figure 2. Ethiopian example of the N2Africa's model to develop private-public partnerships.

IMPACT AND OUTSCALING

The ‘Roots’ Show the Way

THE 'ROOTS' SHOW THE WAY

By Feleke Shiferaw, Victor Manyong, John Ainembabazi, Paul Dontsop, Tahirou Abdoulaye and Arega Alene

In our Refreshed Institutional Strategy for 2012–2020 we commit ourselves to lifting 11 million Africans out of poverty and redirecting some 7 million hectares of underutilized, marginal, and degraded lands to more productive and sustainable use. To realize this, expanding investment in agricultural research and technology development and delivery is crucial.

Agricultural research holds considerable potential for achieving broad-based technological change that benefits the agriculture-dependent poor directly and indirectly. Direct benefits include raising the incomes or home consumption of farmers who adopt the resulting technological innovation; indirect benefits come from the effects of adoption on the real income of others through lower food prices and increased employment and wage effects in agriculture and other sectors.

Sierra Leone, and Zambia, countries where cassava is considered a staple and a major source of livelihood. The survey was conducted under the multi-Center CGIAR "Support to Agricultural Research for Development of Strategic Crops in Africa" (SARD-SC) project, funded by the African Development Bank.

RESEARCH DOES HAVE AN IMPACT ON POVERTY

Adopters of improved varieties account for 34% of the surveyed cassava-growing households, and the intensity of adoption – measured by the proportion of area cultivated to improved varieties – stands at 24%. In terms of poverty status, on average, half of the cassava-growing population is below the poverty line. By country surveyed, the percentages of cassava

11 MILLION AFRICANS

"improved varieties and different indicators of reduced poverty"

Evidence-based studies point to our research-for-development work on cassava as one of our major contributions to reducing poverty, particularly in sub-Saharan Africa through the development and outscaling of improved technologies. Results of a study connect the adoption of improved cassava varieties to poverty reduction in sub-Saharan Africa. The study is part of the Key Performance Indicators (KPI) of poverty and natural resource management evaluated by IITA in 2014. The data used for the impact assessment came from a survey conducted in 2013 involving 2,060 households in selected areas of Tanzania, DR Congo,

Cassava harvest. Photo by IITA

growers that are below the poverty line are 59 for DRC, 43 for Sierra Leone, 34 for Tanzania, and 68 for Zambia. There is a direct relationship between the adoption of the improved varieties and different indicators of reduced poverty, which, in this study, are expressed in terms of productivity gains, per capita income increase, and total reduction in poverty levels.

GAINS IN PRODUCTIVITY

On average, adopters of improved cassava varieties had produced about 9 t/ha. However, had they not adopted improved varieties, they would have produced only 7 t/ha, showing that adoption had led to nearly 30% gains in productivity. Given an average intensity of adoption of 24% and an average cassava farm size of 0.84 ha, the additional production increase/household was 0.4 t. However, had the intensity of adoption increased from 24 to 100%, the production/household would have quadrupled, increasing from 0.4 to 1.7 t (Fig. 1). The additional production increase at the average intensity of adoption would provide enough calories to sustain a household of three members for about three months. But if the head of a household of the same size decided to cultivate the whole of their cassava farm with improved varieties, the additional production gain would allow them to produce enough calories to support them for nearly a year.

"adoption had led to nearly 30% gains in productivity"

BOOST TO PER CAPITA INCOMES

The productivity gains due to the adoption of improved varieties were expected to translate into an increase in the per capita income of members of adopting households. Consistent with expectations, the per capita income of members of households who were observed to have adopted improved varieties was higher than that of non-adopters. The median value was US$1.39/day for adopting households and only $1.24/day for non-adopting households. This is consistent with the calculated poverty rate that nearly 50% of the cassava-growing population were below the poverty line in 2013. Adoption resulted in increasing the average per capita income by $0.26/day. The additional per capita income resulted from the productivity gains of nearly 30% from adoption.

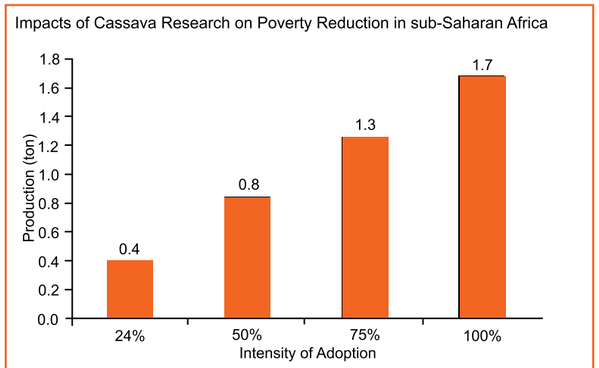


Figure 1. Production increase per farm (tons) at different intensities of adoption

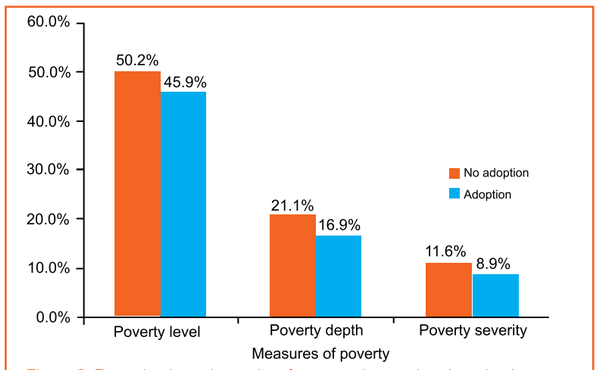


Figure 2. Rate, depth, and severity of poverty observed under adoption and estimated under a scenario of no-adoption

"increasing the average per capita income by $0.26/day"

REDUCTION IN POVERTY LEVELS

The imact of adoption of the improved varieties on poverty reduction was assessed based on the proportion of people lifted above the poverty line (poverty rate), the extent of income shortfall from the poverty line (depth of poverty), and the degree of inequality among the poor themselves (severity of poverty) (Fig. 2). About 46% of the cassava-growing households who adopted improved varieties by 2013 were observed to be living below the poverty line. However, if no adoption had occurred, the poverty rate would have been 50%, indicating that the additional income earned from the production increase due to adoption was responsible for a 4% poverty reduction (all other factors being equal).

Adoption of the improved varieties not only reduced the number of people living below the poverty line but also reduced both the depth and severity of poverty. If the poor households that were observed to have adopted improved varieties by 2013 had not been able to use them, the depth of poverty would have been 4% higher and the severity of poverty would have been 3% higher than those actually observed. In the absence of adoption they would, on average, have an additional 4% income shortfall from the poverty line and experience more income inequality.

COST SAVINGS IN POVERTY REDUCTION

As per capita income increased, the per capita cost of poverty reduction was expected to decline. On average, $52.25/year was required for an individual to be lifted out of poverty in a household that was observed to have adopted improved cassava. However, if the household had not adopted improved varieties by 2013, the per capita

4% POVERTY REDUCTION

"poverty reduction associated with cassava research and the outscaling of improved varieties spearheaded by IITA"

cost required to lift the same individual out of poverty would have been nearly $70, indicating that a per capita cost savings of $18/year could be ascribed to adoption.

QUICKER EXIT FROM POVERTY

As per capita income increased, not only was the per capita cost of poverty reduction reduced; the length of time needed to get out of poverty was also shortened. The expected length of time required to exit poverty was nearly two years shorter under adoption compared with the scenario of no-adoption. In the absence of adoption, the expected length of time required to get out of poverty would have been about two years longer.

These preliminary results establish an empirical relationship between technology adoption and poverty reduction. The findings show some evidence on poverty reduction associated with cassava research and the outscaling of improved varieties spearheaded by IITA and its partners in the study areas. Households that were once living in poverty have escaped poverty, thanks to the adoption of improved varieties. The fact that nearly half of the cassava-growing population in the study areas and 40% of the population in sub-Saharan Africa would still continue to remain poor beyond 2015 underscores the importance of continued investment in agricultural research and development in the region for cassava and other crops.

Women bringing cassava to the market. Photo by IITA

Generose Nziguheba

Soil Ecologist

"I joined IITA because its research contributes towards increasing agricultural productivity and food security in Africa. I was based at IITA-Ibadan in Nigeria from 2005-2007, and I have been collaborating with the institute through projects at my previous job at Columbia University. When an opportunity to 'come back home' to IITA, I grabbed it," says Generose Nziguheba, soil ecologist based in Nairobi, Kenya.

"Since joining, I have being conducting research on two main aspects: assessing the key performance indicators for sustainable land use, and tapping into the underexploited potential of multi-purpose legumes to improve livelihoods and create a better environment in crop-livestock systems in East and Central Africa. My countries of focus are Burundi, DRC, Ethiopia, Kenya, and Rwanda."

"My research on key performance indicators for sustainable land use contributes to one of IITA's strategic goals in its Refreshed Strategy: turning 7.5 million hectares of degraded farm land back into sustainable use. But beyond IITA, my research focuses on sustainable agricultural intensification –how agricultural productivity can be increased without causing negative effects on the environment and other services. This is a must if smallholder farmers in sub-Saharan Africa are to overcome food insecurity and improve their livelihoods."

TRAINING

TRAINING AND SEMINARS

TRAINING

In 2014, IITA continued its efforts in building capacity of staff and partners in the national agricultural research systems (NARS) as a component of its overall strategic targets. IITA acknowledges the importance of sharing knowledge and facilitates this information exchange via various training activities, seminars, and degree-related programs for individuals and groups.

IITA looks to enhance the skillset of stakeholders in regional locations, with a view to facilitating capacity building needs of selected target groups. IITA has constantly developed different training strategies and delivery methods to meet the requirements of targeted beneficiaries. IITA's strategy for training includes graduate research, individual attachments, and the development and distribution of training materials. The emphasis has been on improving the capacities of scientists and technicians from the national systems. Training approaches have included key targeted programs such as Professional Capacity Advancement Program, Graduate Research Program, and Short-term Courses. IITA also organized, with partners, a number of research themed seminars and workshops undertaken to support the knowledge exchange.

DEGREE-RELATED TRAINING

During 2014, 107 postgraduate students from universities within and outside Africa were recruited, (45 PhD and 62 MSc). The total number of students was 107 with 58 males and 49 females. These students were spread across the IITA hubs as follows: West Africa (66), East Africa (27), Central Africa (10) and Southern Africa (4).

Within the same period, 105 postgraduate fellows completed the research portion of their degrees at IITA (35 PhD and 70 MSc): 65 males and 40 females from 27 countries. These fellowships were distributed across the hubs as follows: West Africa (53), East Africa (41), Southern Africa (8,) and Central Africa (3).

The programs were designed to give the students opportunities to conduct their field work in the tropics. These cut across the following areas: Roots and Tubers (26%), Agrobiodiversity (31%), Cereals and Legumes (30%), Agriculture and Health (5%), Banana & Plantain (7%), and Horticulture and Tree Crops (1%).

To view the list of graduate and post graduate training in 2014, click here.

Group training conducted in 2014 (including NARS related capacity building activities)

These courses include capacity building activities related to the national agricultural research systems (NARS) and deal with various aspects of agricultural production in Africa. They are organized to help large numbers of agricultural research and extension workers and farmers meet their goals and cope with problems as they arise. A total of 8,125 participants (5,589 males and 2,536 females) participated in 174 different training spread over 22 countries all over Africa. The table shows the breakdown of training by hub/region.

Breakdown of students in 2014, by program and by hub.

By program	PhD		MSc		Total		Total
	M	F	M	F	M	F	
Students graduated	22	13	43	27	65	40	105
Students recruited	26	19	32	30	58	49	107

By hub	Central Africa	Eastern Africa	Southern Africa	Western Africa
Students graduated	3	41	8	53
Students recruited	10	27	4	66

Hub	Training (no.)
Central Africa	26
Eastern Africa	40
Southern Africa	27
Western Africa	79
Total	174

Training were organized under the following themes: Cereals and Legumes systems, Agriculture and Health, Agrobiodiversity, Roots and Tuber systems, Banana and Plantain systems, Horticulture and Tree Crops systems.

To view the complete list of training for 2014, click here .

SEMINAR PRESENTATIONS

As part of IITA's knowledge sharing efforts, seminar presentations were conducted showcasing various aspects of the institute's operations and research activities. There were quite a number of presentations undertaken during the year from the different hubs and regions. The breakdown of the seminar presentations were as follows:

Summary of seminar presentations by hub and by research theme.

Region	Presentations (no.)
Central Africa	20
Eastern Africa	43
Southern Africa	4
Western Africa	26
Research theme	
Administration	5
Biotechnology and plant breeding	17
Natural resource management	9
Plant production and health	10
Social science and agribusiness	22

Central Africa (20), Eastern Africa (43), Southern Africa (4), and Western Africa (26). These presentations were also grouped by the following types: Administration (5), Biotechnology and plant breeding (17), Natural resource management (9), Plant production and health (10), and Social science and agribusiness (22).

DEVELOPING CAPACITY IN PROJECT ADMINISTRATION

IITA's mission to offer leading research partnership that facilitates agricultural solutions for hunger, poverty, and natural resource degradation throughout the tropics, needs to be supported by the administrative capacity of IITA and its partners, to deliver what it has set out to do, especially to deliver what it has agreed to do under its projects.

The Project Administration Office (PAO) protects IITA against unforeseen contract, legal, and financial issues; serves as a reliable source of data warehousing; and also establishes sound operational procedures to guarantee adherence to donor requirements.

As our success depends largely on our partnerships, capacity building of national partners is very important to us. Over the years, IITA has been working with partners to achieve this.

As a way to assist partners to develop their capacity in project administration, PAO started to organize annual fee-paying workshops for partners on 'Proposal Writing, Grants, Contract Database Management, Project Administratic and Intellectual Property (IP)' from 2013. 2014, the 3-day training, organized in Ibada attracted 41 participants from IITA's nation partners (31 male and 10 female) and oth related agricultural institutions from within ar outside Nigeria. The participants displayed lo of enthusiasm and positive spirit throughout th sessions, with encouraging feedback. The ai for the future is to organize similar training in a of IITA's Hubs.

A seminar in Project Administration w organized for the IITA Youth Agripreneurs (IY in 2014 to support efficient service delivery partners and donors. The purpose of the trainir was to equip IYA members with the knowled and skills required for administering projec with topics such as Developing Grants Propos Budgets, Intellectual Assets/Property (I/A or I/ and Project Database management. Emphas was also made on the need to provide polit timely, effective, and satisfactory respons to requests and a quick turn-over of quali services to internal and external clients with expected time limits, for building commercial successful enterprises.

Nester Mashingaidze

Postdoctoral Researcher, Burundi

I work on farming systems analysis, first under the Africa RISING (Africa Research in Sustainable Intensification for the Next Generation) project while I was based at Wageningen University with the Farming Systems Ecology Group, and now in the IITA-led CGIAR Research Program on Integrated Systems for the Humid Tropics (Humidtropics).

My research looks at how to optimize the multiple objectives of farmers when selecting and adopting technologies. These include yield/production, natural resource management (NRM), and profit and nutrition at farm and landscape levels. By modeling the current farmers' practices and new technical innovations using bioeconomic models such as FarmDESIGN we are able to identify the tradeoffs and synergies between these multiple objectives. These can then be used to demonstrate to agricultural actors the interactions between the various components at farm and landscape levels and to guide discussions on identifying the best-fit technologies.

I joined IITA because the institute offered me a chance to work with leading scientists from IITA and Wageningen University Research in this exciting area of farming systems analysis. I enjoy and appreciate working with researchers from different disciplines and backgrounds who share the common vision to improve livelihoods of smallholder farmers. This provides a holistic approach to research which may result in better targeting and adoption of technologies by farmers. I am also learning a lot as I try to understand how farmers make decisions. This has made me realize that there is so much more to learn and this keeps me motivated.

PROJECT MANAGEMENT

TOWARDS EFFICIENT AND EFFECTIVE PROJECT ADMINISTRATION

IITA's mission to offer leading research partnership that facilitates agricultural solutions for hunger, poverty, and natural resource degradation throughout the tropics, needs to be supported by the administrative capacity of IITA and its partners, to deliver what it has set out to do, especially to deliver what it has agreed to do under its projects.

The Project Administration Office (PAO) of IITA protects the institute against unforeseen contract, legal and financial issues, serves as a reliable source of data warehousing and also establishes sound operational procedures to guarantee adherence to donor requirements. PAO also assists scientists and partners by giving explanation, advice, and interpretation where necessary.

In 2014, the PAO administered a total of 208 projects. Out of those, 9 were the projects under the CGIAR Research Programs (CRP) and 17 were CRP-related or adjunct projects (Windows 1 and 2 funds with separate agreements), 37 were Window 3 projects, and 145 were bilateral projects.

There has been a progressive growth in large projects over the previous years, and these larger projects increased the number of subcontractors or partners for IITA as under larger projects there is more cooperation with partners (see related section "New Partnerships", page 48). The subcontract agreements issued to partners under the projects increased by almost three folds between 2011 and 2014, from 248 in 2011 to 682 in 2014. Some partners are subcontracted under several projects, but the total number of partners, with which IITA works together with, also increased substantially, from 176 in 2011 to 409 in 2014.

As IITA's success depends largely on our partnerships, external capacity building of national partners is very important to IITA. Over the years, IITA has been working with partners to achieve this. As one new way to assist partners to develop their capacity in project administration, PAO started to organize annual fee-paying workshops for partners on 'Proposal Writing, Grants, Contracts, Database Management, Project Administration and Intellectual Property (IP)' starting 2013. In 2014, the three-day training, organized at IITA's Headquarters in Ibadan, attracted 41 participants from national partners and other agricultural institutions from within and outside Nigeria. The PAO hopes to organize similar training in all of IITA's regional hubs.

409 PARTNERS

A seminar in Project Administration was organized for the IITA Youth Agripreneurs (IYA) in 2014 to support the Ibadan chapter of the IYA to better deliver its services to partners and donors. The purpose of the training was to equip the IYA members with the knowledge and skills required for administering projects with topics such as Developing Grants Proposal Budgets, Intellectual Assets/Property (I/A or I/P), and Project Database Management. The training also emphasized on business etiquettes, efficient responses to requests, and a quick turnaround of quality services to internal and external clients.

PAO, being the focal point for the CGIAR Intellectual Assets (IA) Principles, is also responsible for the institute's compliance to these principles. A list of 110 project-related agreements and 58 Memoranda of Understanding and other non-project related agreements signed in 2014 by IITA was reviewed by PAO for compliance. The IA compliance report was submitted to the CGIAR CO and Fund Council IP Group, who cited IITA's 'Aflatoxin biocontrol product', saying that "it is great to see IITA entering into such innovative scale-up arrangements". As a result, the CGIAR is looking at including the report as a case study highlighting the innovative use of registered IP rights and/or commercialization models used by CGIAR Centers in the 2014 CGIAR Annual Report.

Project Administration Office (PAO)

208 PROJECTS

9 CRP | **17 CRP Related or Windows 1/2** | **37 Window 3** | **145 Bilateral**

NEW PARTNERS

NEW PARTNERS

33 MOUs

NEW PARTNERS

In 2014, IITA signed 33 Memoranda of Understanding (MoUs) and two Collaboration Agreements for general partnership and cooperation with new partners as well as to formalize existing partnerships. Table 1. General partnership and cooperation agreements signed between IITA and partners in 2014

Description of Agreement	Start date	End date	Date of Signing
Memorandum of Understanding between IITA and Pwani University (PU)	01/06/2014	01/05/2019	01/06/2014
Letter of Agreement (LoA) on Collaboration in Research, Capacity Building and Networking between IITA and GlobalHort - The Global Horticulture Initiative	01/01/2014	31/12/2015	22/01/2014
Memorandum of Understanding between IITA and Doreo Partners (DP)	23/01/2014	22/01/2019	13/01/2014
Memorandum of Understanding between IITA and Universidad Earth (Earth University)	02/04/2014	02/03/2019	02/04/2014
Memorandum of Understanding between IITA and Uka Tarsadia University (UTU)	14/02/2014	13/02/2019	14/02/2014
Memorandum of Understanding between IITA and the University of BUEA, Cameroon	03/06/2014	03/05/2019	03/06/2014
Collaboration Agreement between IITA and the Agriculture and Food Security Center	18/03/2014	none	18/03/2014
Memorandum of Understanding between IITA and University of Lausanne, Faculty of Biology and Medicine	20/03/2014	19/03/2019	20/03/2014
Memorandum of Understanding between IITA and Kenya Agricultural Research Institute (KARI)	04/01/2014	31/03/2019	04/01/2014
Memorandum of Understanding between IITA and ICL Africa (Dead Sea Works Ltd)	04/12/2014	none	04/12/2014
Memorandum of Understanding between IITA and Zero Gravity Solutions Ltd	17/04/2014	16/04/2019	17/04/2014
Memorandum of Understanding between IITA and Osun State University (UNIOSUN)	28/05/2014	27/05/2019	28/05/2014
Memorandum of Understanding between IITA and JR BIOTEK LLC	06/04/2014	06/03/2016	06/04/2014
Memorandum of Understanding between IITA and Flour Mills of Nigeria Plc (FMN)	30/06/2014	29/06/2019	30/06/2014
Memorandum of Understanding between Committee on Sustainability Assessment (COSA) and IITA	07/04/2014	none	07/04/2014
Memorandum of Understanding between IITA and Roots Biochemical Products Ltd (RBPL)	22/07/2014	21/07/2019	22/07/2014
Memorandum of Understanding between IITA and Human & Environmental Development Agenda Resource Center (HEDA)	08/07/2014	08/06/2019	08/07/2014
Memorandum of Understanding between IITA and Plant Health Products (Pty) Ltd	09/02/2014	09/01/2019	09/02/2014
Memorandum of Understanding between IITA and L'Universite Catholique De Bukavu (UCB)	28/08/2014	27/08/2019	09/05/2014
Memorandum of Understanding between IITA and Millennium Development Goals Project Support Unit (APO Legis- lative Quarters, Abuja, FCT-DEPR&S (MDGs)	09/04/2014	09/03/2019	09/04/2014
Memorandum of Understanding between IITA and Taiyo Industry Africa Inc. (Taiyo Industry Africa)	09/12/2014	09/11/2014	09/12/2014
Memorandum of Understanding between IITA and A.P. Leventis Ornithological Research Institute (APLORI)	15/09/2014	14/09/2019	15/09/2014
Memorandum of Understanding between IITA and Federal University of Technology Minna, Niger State (FUT Minna)	05/03/2014	04/03/2019	05/03/2014
Agreement between IITA and The Nelson Mandela African Institution of Science and Technology (NM-AIST)	25/09/2014	24/09/2019	25/09/2014
Memorandum of Understanding between IITA and AVRDC - The World Vegetable Center	30/09/2014	29/09/2019	30/09/2014
Memorandum of Understanding between IITA and Crops for the Future Research Center (CFFRC)	25/09/2014	24/09/2017	25/09/2014
Memorandum of Understanding between IITA and The Agriculture and Food Development Authority of Ireland	10/02/2014	10/01/2019	10/02/2014
Memorandum of Understanding between IITA and Regional Universities Forum for Capacity Building in Agriculture (RUFORUM)	15/10/2014	14/10/2019	15/10/2014
Memorandum of Understanding between IITA and Catholic Diocese of Bukavu, South Kivu	17/10/2014	16/10/2019	17/10/2014
Memorandum of Understanding between DAI/Africa Lead II - West Africa Office (Feed the Future: Building Capacity for African Agricultural Transformation Program and IITA for Capacity Development Services	11/07/2014	none	11/07/2014
Memorandum of Understanding between IITA and Association of Non-Indigenous Residents in Oyo State (ANIRO)	11/01/2014	31/10/2017	11/01/2014

Memorandum of Agreement between Tennessee State University and IITA	12/01/2014	30/11/2019	12/01/2014
Protocole d'Accord entre IITA et Cooperation Technique Belge (CTB)	10/12/2014	09/12/2019	17/12/2014
Memorandum of Understanding between IITA and Cosmo Farmers Ltd	18/12/2014	17/12/2017	18/12/2014
Memorandum of Agreement between IITA and the University of Connecticut	11/05/2014	11/04/2017	11/05/2014

12 projects

For specific projects, IITA signed four MoUs and 12 other types of agreements with new partners or funders. Some of the new partners were private partners, but the majority were public partners. Table 2. Specific project agreements signed between IITA and partners in 2014

Project Title	Start date	End date	Date of signing	Type of Agreement
Sustainable Intensification of Key Farming Systems in the Sudano-Sahelian Zone of West Africa	01/01/2014	31/12/2015	07/02/2014	Memorandum of Understanding between IITA and Heifer Project Interna- tional (HI)
Institutionalization of quality assurance mechanism and dissemination of top quality commercial products to increase crop yields and improve food security of smallholder farmers in sub-Saharan Africa – COMPRO-II	19/02/2014	31/12/2016	19/02/2014	Memorandum of Understanding between IITA and African Fertilizer Agro-business Partnership (AFAP) for the project: "Institutionalization of quality assurance mechanism and dissemination of top quality commercial products to increase crop yields and improve food security of smallholder farmers in sub-Saharan Africa – COMPRO-II"
The Multinational - CGIAR Project: Support to Agricultural Research for Development on Strategic Commodities in Africa (SARD-SC) {CASSAVA}	03/01/2014	31/01/2017	29/01/2014	Research Agreement (Research Project: Support to Agricultural Research for Development of Strategic Crops in Africa (SARD-SC) between International Potash Institute (IPI) & IITA
Sustainable Weed Management Technologies for Cassava Systems in Nigeria	04/01/2014	31/03/2016	04/01/2014	Evaluation Agreement between Bayer Crop Science AG and IITA
Cassava Seed, Maize and Sorghum System (Système semencier du manioc, mais et sorgho)	03/04/2014	31/12/2018	03/04/2014	Partnership Agreement (PA) between The Agricultural Investment and Mar- kets Development Project (PIDMA) and IITA for the "Supply of improved and bio-fortified cassava varieties"
Development of Herbicide Tolerant Cassava for Nigerian Smallholder Farmers	13/11/2013	31/10/2014	03/10/2014	Non-Federal Subaward Agreement between The Regents of the University of Minnesota and IITA
Putting Nitrogen Fixation to Work for Smallholder Farmers in Africa (N2Africa) Phase II (BMGF Grant No. OPP1020032)	22/12/2014	30/11/2016	22/12/2014	Memorandum of Understanding between IITA and Busaka Agribusiness Company Ltd (BUSAKA)
Skills Development Program for Syngenta Staff and Partners	04/02/2014	31/12/2017	14/07/2014	Between Syngenta Nigeria Ltd and IITA relating to and incorporating the Supply Agreement between Syngenta Crop Protection AG and IITA
PARRSA/IITA Training on Cassava Processing Techniques	03/03/2014	07/02/2014	03/03/2014	Memorandum of Understanding between *Projet à la Réhabilitation et la Re- lance du Secteur Agricole* (PARRSA) and IITA to conduct training on cassava processing techniques
Upgrading Ondo State Agricultural Village, Ore	07/01/2014	31/12/2015	13/08/2014	Agreement between Ondo State Wealth Creation Agency (WECA) and IITA for "Upgrading Ondo State Agricultural Village, Ore"
Cassava BBTD in Gabon	10/01/2014	31/01/2016	10/09/2014	Convention de Collaboration entre PDAR et IITA
Yam varieties for food Industry In Nigeria - Industrial Trials	18/06/2014	17/06/2015	18/06/2014	Letter of Agreement between Primlaks Nigeria Limited & her associated companies and IITA for "Yam Varieties for Food Industry in Nigeria - Industri- al Trials"
Sorghum genotyping for Nigerian Breweries	19/08/2014		19/08/2014	Letter of Agreement between Nigerian Breweries Plc and IITA for "Sorghum Genotyping for Nigerian Breweries"
Climate Change Adaptation in Coffee Production in Uganda	07/01/2014	30/06/2015	09/11/2014	Consultancy Contract between Hanns R. Neumann Stiftung Africa (HRNS) and IITA
On-farm research to test the effectiveness and acceptance of different storage technologies for maize	22/09/2014	21/09/2015	22/09/2014	Agreement between IITA and Helvetas Swiss Intercooperation


IITA

NEW PUBLICATIONS

PUBLICATIONS

In 2014, IITA scientists published 240 publications, including journal articles, books and booklets, book chapters, manuals, proceedings, technical reports and various other publications. Journal articles totaled 169, with 121 published in peer-reviewed, Thomson-indexed journals. Selected articles from the different hubs are presented here by research theme.

Natural resource management

- Asare R. Afari-Sefa V, Osei-Owusu Y, and Pabi O. 2014. Cocoa agroforestry for increasing forest connectivity in a fragmented landscape in Ghana. Agroforestry Systems, 1–14. (Online first)
- Desloover J, Roobroeck D, Heylen K, Puig S, Boeckx P, Verstraete W, and Boon N. 2014. Pathway of nitrous oxide consumption in isolated Pseudomonas stutzeri strains under anoxic and oxic conditions. Environmental Microbiology, 1–10.
- Klapwijk CJ, Bucagu C, van Wijk MT, Udo HMJ, Vanlauwe B, Munyanziza E, and Giller K. 2014. The 'one cow per poor family' programme: current and potential fodder availability within smallholder farming systems in Southwest Rwanda. Agricultural Systems, 131: 11–22.
- Klapwijk CJ, van Wijk MT, Rosenstock TS, Van Asten P, Thornton P, and Giller K. 2014. Analysis of trade-offs in agricultural systems: current status and way forward. Current Opinion in Environmental Sustainability, 6: 110–115
- Leip A, Leach A, Musinguzi P, Tumwesigye T, Olupot G, Tenywa JS, Mudiope J, Hutton O, Cordovil CM, Bekunda M, and Galloway JN. 2014. Nitrogen-neutrality: a step towards sustainability. Environmental Research Letters, 9: 1–10.
- Nyamangara J, Mashingaidze N, Masvaya EN, Nyengerai K, Kunzekweguta M, Tirivavi R, and Mazvimavi K. 2014. Weed growth and labour demand under hand-hoe based reduced tillage in smallholder farmers' fields in Zimbabwe. Agriculture, Ecosystems & Environment.
- Ojiem JO, Franke AC, Vanlauwe B, de Ridder N, and Giller K. 2014. Benefits of legume-maize rotations: assessing the impact of diversity on the productivity of smallholders in Western Kenya. Field Crops Research, 168: 75–85.
- Rasche F, Musyoki MK, Rohl C, Muema EK, Vanlauwe B, and Cadisch G. 2014. Lasting influence of biochemically contrasting organic inputs on abundance and community structure of total and proteolytic bacteria in tropical soils. Soil Biology and Biochemistry, 74: 204–213.
- Schut M, Cunha Soares N, van de Ven GWJ, Slingerland M. 2014. Multi-actor governance of sustainable biofuels in developing countries: The case of Mozambique. Energy Policy 65: 631–643.
- Taulya G, Van Asten P, Leffelaar PA, and Giller K. 2014. Phenological development of East African highland banana involves trade-offs between physiological age and chronological age. European Journal of Agronomy, 60: 41–53.

Kwadwo Obeng-Antwi

Country Coordinator
SARD-SC Maize, Ghana

"I joined IITA because I thought my experience of collaboratively working with IITA as maize breeder on several projects would be invaluable to the institute and in my new role," says Dr Kwadwo Obeng-Antwi, Country Coordinator for Ghana under the SARD-SC Maize Project and based in Kumasi. He previously worked also as Country Coordinator for Ghana but on the Drought Tolerant Maize for Africa (DTMA) Project.

"I provide technical backstopping to national partners and stakeholders of the maize value chain organized in three Innovation Platforms (IPs): Forest, Transition, and Guinea Savanna IPs in Ghana and are based in their respective agro-ecological zones. The stakeholders meet regularly to discuss and resolve issues of common interest."

"At first, bringing together these diverse stakeholders with their diverse needs, interests and preferences to a common platform was challenging. However, after a series of meetings and discussions, the initial fears and suspicions by the various stakeholders gave way to oneness and a common purpose."

"What I enjoy the most about my new role is the shift from on-station research to one that involves interacting with a wide range of stakeholders outside the formal research system – from farmers to traders to policymakers – to find win-win solutions to challenges."

- Vanlauwe B, Coyne D, Gockowski J, Hauser S, Huising JE, and Masso C, et al. 2014. Sustainable intensification and the African smallholder farmer. Current Opinion in Environmental Sustainability, 8: 15–22.
- Vanlauwe B, Wendt J, Giller K, Corbeels M, Gerard B, and Nolte C. 2014. A fourth principle is required to define conservation agriculture in sub-Saharan Africa: the appropriate use of fertilizer to enhance crop productivity. Field Crops Research, 155: 10–13.

Plant breeding and biotechnology

- Duc D, Agrama H, Bao SY, Berger J, Bourion V, De Ron AM, Gowda CLL, Mikic A, Millot D, Singh K, Tullu A, Vandenberg A, Vaz Patto MC, Warkentin TD, and Zong XX. 2014. Breeding annual grain legumes for sustainable agriculture: New methods to approach complex traits and target new cultivar ideotypes. Critical Reviews in Plant Sciences Volume 34: 381–411.
- Ezekiel CN, Warth B, Ogara I, Abia W, Ezekiel V, Atehnkeng J, Sulyok M, Turner P, Tayo G, Krska R, and Bandyopadhyay R. 2014. Mycotoxin exposure in rural residents in northern Nigeria: a pilot study using multi-urinary biomarkers. Genetic differentiation among Maruca vitrata F. (Lepidoptera: Crambidae) populations on cultivated cowpea and wild host plants: implications for insect resistance management and biological control strategies. Environment International, 66: 138–145.
- Girma G, Hyma KE, Asiedu R, Mitchell SE, Gedil M, and Spillane C. Next-generation sequencing based genotyping, cytometry and phenotyping for understanding diversity and evolution of guinea yams. Theoretical and Applied Genetics. 127: 1783–1794.
- Menkir A, Gedil M, Tanumihardjo SA, Adepoju A, and Bossey B. 2014. Carotenoid accumulation and agronomic performance of maize hybrids involving parental combinations from different marker-based groups. Food Chemistry, 148(1): 131–137.
- Nhamo N, Kyako G, Dinheiro V. 2014. Exploring options for lowland rice intensification under rainfed and irrigated ecologies in East and Southern Africa: The potential application of integrated soil fertility management principles. Advances in Agronomy 128: 183–219.
- Nhamo, N., Makoka D, and Tabi FO. 2014. Adaptation strategies to climate change among smallholder farmers in the Volta region of Ghana. British Journal of Applied Science and Technology 4(1): 198–213.
- Nyaboga E, Tripathi J, Manoharan R, and Tripathi L. 2014. Agrobacterium-mediated genetic transformation of yam (Dioscorea rotundata): an important tool for functional study of genes and crop improvement. Frontiers in Plant Science, 5: 1–14.
- Rabbi IY, Hamblin M, Kumar PL, Gedil M, Ikpan A, Jannink J, and Kulakow P. 2014. High-resolution mapping of resistance to cassava mosaic geminiviruses in cassava using genotyping-by-sequencing and its implications for breeding. Virus Research. 1–10. (Online first)
- Riveron J, Yunta C, Ibrahim S, Djouaka RF, Irving H, Menze B, Ismail H, Hemingway J, Ranson H, Albert A, and Wondji CS. 2014. A single mutation in the GSTe2 gene allows tracking of metabolically based insecticide resistance in a major malaria vector. Genome Biology, 15(2): 1–20.
- Ortiz R and Swennen R. 2014. From crossbreeding to biotechnology-facilitated improvement of banana and plantain. Biotechnology Advances, 32: 158–169.

Tariro Mutamuko

Head of Internal Audit
Nigeria

I joined IITA because I felt the need to consolidate my extensive experience in governance, risk and compliances within commercial environments into a developmental set up and in an institution working on addressing major challenges facing Africa. My career path was aligned to IITA's vision and I felt motivated to work for such an organization that has broad African footprints.

Furthermore, I was very keen on some of its initiatives such as the Business Incubation Platform (BIP) since I have worked in commercial conglomerates. My key focus, and that of my unit, is on governance, risk, internal controls, and compliances across the whole of IITA. Our work is to ensure that IITA maintains appropriate accountability and transparency in all its dealings with the various stakeholders. I have also been working on establishing a comprehensive risk-based audit strategy and develop the audit unit's consulting activities that will provide consulting intervention in governance, risk, and compliance. Our work as independent assurance and advisory providers will especially focus on supporting IITA to achieve its goals and objectives as spelt out in its revised strategy 2012-2020.

One notable thing I have experienced within IITA has been my fluid integration within the diverse sociocultural environment. I also enjoy the diversity of people I work with which gives me opportunities to review and advice on internal controls and risk management systems across the different sectors both in research projects and administration and support.

- Tripathi J, Lorenzen J, Bahar O, Ronald P, and Tripathi L. 2014 Transgenic expression of the rice Xa21 pattern-recognition receptor in banana (Musa sp.) confers resistance to Xanthomonas campestris pv. musacearum. Plant Biotechnology Journal, 1–11.
- Tripathi L, Tripathi J, Kiggundu A, Korie S, Shotkoski F, and Tushemereirwe WK. 2014. Field trial of Xanthomonas wilt disease-resistant bananas in East Africa. Nature Biotechnology, 32: 868–870.

Plant production and health

- Agunbiade T, Coates BS, Datinon B, Djouaka RF, Sun W, Tamo M, and Pittendrigh BR. 2014. Genetic differentiation among Maruca vitrata F. (Lepidoptera: Crambidae) populations on cultivated cowpea and wild host plants: implications for insect resistance management and biological control strategies. PLoS One, 9(3): 1–9.
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- Holscher D, Dhakshinamoorthy S, Alexandrov T, Becker M, Bretschneider T, Buerkert A, Crecelius AC, De Waele D, Elsen A, Heckel DG, Heklau H, Hertweck C, Kai M, Knop K, Krafft C, Maddula RK, Matthaus C, Popp J, Schneider B, Schubert US, Sikora R, Svatos A, and Swennen R. 2014. Phenalenone-type phytoalexins mediate resistance of banana plants (Musa spp.) to the burrowing nematode Radopholus similis. In: Proceedings of the National Academy of Sciences of the United States of America (PNAS), 111: 105–110.
- Kamara AY, Ewansiha SU, Boahen SK, and Tofa AI. 2014. Agronomic response of soybean varieties to plant population in the Guinea Savannas of Nigeria. Agron. J. 106: 1051–1059.
- Kamara A, Ekeleme F, Jibrin JM, Tarawali G, and Tofa A. 2014. Assessment of level, extent and factors influencing Striga infestation of cereals and cowpea in a Sudan savanna ecology of northern Nigeria. Agriculture, Ecosystems and Environment, 188: 111–121.
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- Mbewe W, Kumar PL, Changadeya W, Ntawuruhunga P, and Legg J. 2014. Diversity spread of Cassava brown streak disease, and its effect on cassava cultivars in Malawi. Journal of Phytopathology - Decision on Manuscript ID JPHY-14-170.
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Michael Haertel

GIS And Database Expert, Nigeria

When I was a child I had a home computer on which I played a game called 'Heart of Africa'. It was a very simple, non-graphics impressive game, but its atmosphere made me feel that I have to visit Africa when I grow up.

My tasks are mainly related to GIS, remote sensing, and data management. I am in charge of establishing an internet-based platform (catalog service) for making geo-spatial data accessible to the public. I am also exploring new methodologies to predict yield data by experimenting with various geo-statistical models that use environmental data such as precipitation or temperature as an input to explain the spatial distribution of observed phenomena (yields, pest or variety distribution). This will guide the institute in selecting sites for trials and support in scaling out its agricultural inventions.

I am also involved in the process of defining a widely accepted standard for saving data from field experiments or agronomic trials. In the past when a scientist left the institute, data was either lost or is of no use because all the information about the data (metadata) was missing.

While demanding, my work at IITA is exciting and interesting. IITA is still largely behind in terms of data management and 'knowledge distribution". I think I can help the institute improve in this area.

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- Seal S, Turaki A, Muller E, Kumar PL, Kenyon L, Filloux D, Galzi S, Lopez-Montes A, and Iskra-Caruana ML. 2014. The prevalence of badnaviruses in West African yams (Dioscorea cayenensis-rotundata) and evidence of endogenous pararetrovirus sequences in their genomes. Virus Research, 186: 144–154.

Social science and agribusiness

- Abass A, Ndunguru G, Mamiro P, Alenkhe B, Mlingi N, and Bekunda M. 2014. Post-harvest food losses in a maize-based farming system of semi-arid savannah area of Tanzania. Journal of Stored Products Research, 57: 49–57.
- Abdoulaye T, Abass A, Maziya-Dixon B, Tarawali G, Okechukwu R, Rusike J, Alene AD, Manyong VM, and Ayedun B. 2014. Awareness and adoption of improved cassava varieties and processing technologies in Nigeria. Journal of Development and Agricultural Economics 6(2): 67–75.
- Ainembabazi JH and Angelsen A. 2014. Do commercial forest plantations reduce pressure on natural forests? Evidence from forest policy reforms in Uganda. Forest Policy and Economics, 40: 48–56.
- Asres E, Nohmi M, Yasunobu K, Ishida A, and Alene AD. 2014. The effect of agricultural extension service on technical efficiency of teff producers in Ethiopia. American Journal of Applied Sciences 11(2): 223–239.
- Khonje M, Manda J, Alene AD, and Kassie M. Analysis of adoption and impacts of improved maize varieties in Eastern Zambia. World Development. 2015. Volume 66: 695–706
- Manda J, Khonje M, Alene AD, Kassie M, and Mutenje M. Determinants of child nutritional status in the Eastern Province of Zambia: The role on improved varieties. Submitted to World Development. (accepted)
- Mignouna DB, Abdoulaye T, Alene A, Aighewi B, Pelemo O, Manyong VM, Asiedu R, and Akoroda M. 2013. Economic Analysis of Seed Yam Production Systems in Nigeria. Journal of Root Crops, 39 (2): 221–229.
- Moussa B, Abdoulaye T, Coulibaly O, Baributsa D, and Lowenberg-DeBoer J. 2014. Adoption of on-farm hermetic storage for cowpea in West and Central Africa in 2012. Journal of Stored Products Research. 1–10. (Online first)
- Rusike J, Mahungu NM, Lukombo SS, Kendenga T, Bidiaka SM, Alene AD, Lema A, and Manyong VM. 2014. Does a cassava research-for-development program have impact at the farm level? Evidence from the Democratic Republic of Congo. Food Policy 46: 193–204.

Food and nutrition science

- Muoki PN, Kinnear M, Emmambux MN, and Kock HL. 2014. Effect of the addition of soy flour on sensory quality of extrusion and conventionally cooked cassava complementary porridges. Journal of the Science of Food and Agriculture. 2015. 95(4): 730–8. doi: 10.1002/jsfa.6820. Epub 2014 Sep 4.

Marcello Precoppe

Postdoctoral Fellow on Improving Cassava Processing Efficiency

In sub-Saharan Africa, cassava is the principal source of calories for the local population. Cassava is highly perishable and for this reason, throughout history the roots have been processed to extend their shelf life.

Processing methods vary widely according to the region, but in several African countries cassava roots are dried, milled into flour, and later used as the basis for many dishes. Traditionally, the roots are dried in the sun, but to obtain a higher quality and hygienic product, a dryer is required.

Dryer design needs to be tailored to the characteristics of the users. For smallholder farmers the dryer should be of low capital and maintenance cost, of suitable processing capacity, and simple to operate. State-of-the-art dryers for cassava are available and are used by the food industry, but these are not suitable for smallholder farmers. On the other hand, the existing dryers suitable to smallholder farmers are still on the early stage of development, have low energy efficiency, and the resulting product is of poor quality. The objective of my work therefore at IITA is to develop an energy efficient dryer, suitable to smallholder farmers, and able to produce a high quality product.

I joined IITA to work for an international research institution. I was thrilled by the idea of working in a multicultural environment with people from different parts of the world and different academic backgrounds.

OUR FINANCES AND SUPPORTERS

OUR FINANCES AND SUPPORTERS

FUNDING OVERVIEW

Funding for 2014 was US$109.480 million, of which 99.29% came from CGIAR investors and 0.71% from other sources. Expenditures were $108.176 million (net of indirect cost recovery of $10.102 million), of which 89.38% was used for program expenses and 10.62% for management and general expenses. Figure 1 shows the governments and agencies that provided the largest share of our funding in 2013 and 2014 (top 10 donors). IITA`s 2013 and 2014 total funding are reflected in Figure 2.

US$109.480 MILLION

Figure 2. 2014 Investment by CGIAR Research Programs budget.

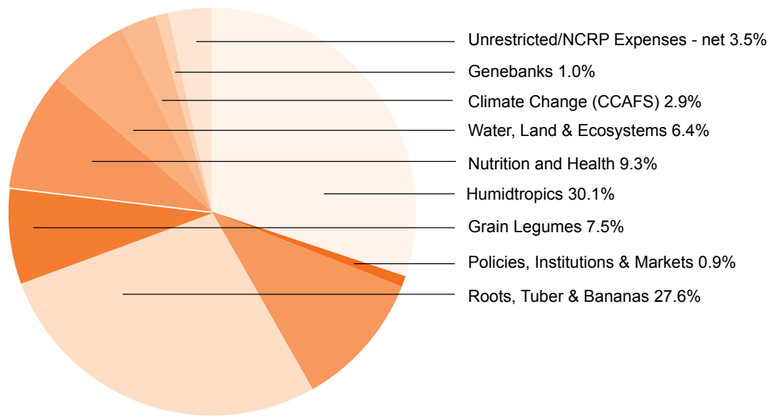


Figure 3. 2014 Investment by CGIAR Research Programs expenditure.

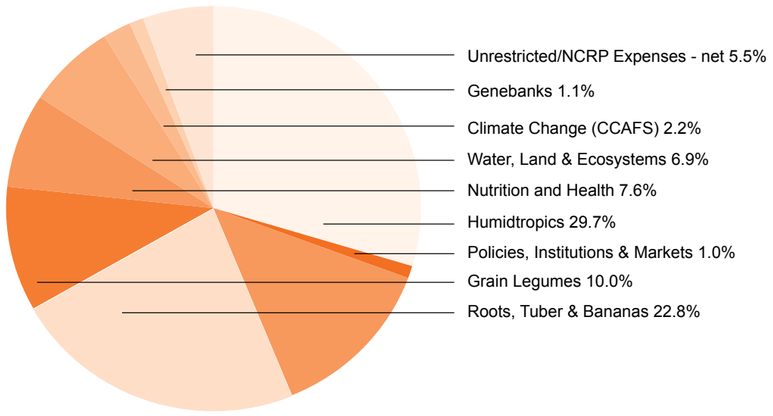


Figure 1.
Funding: Top 10 donors, 2013 and 2014

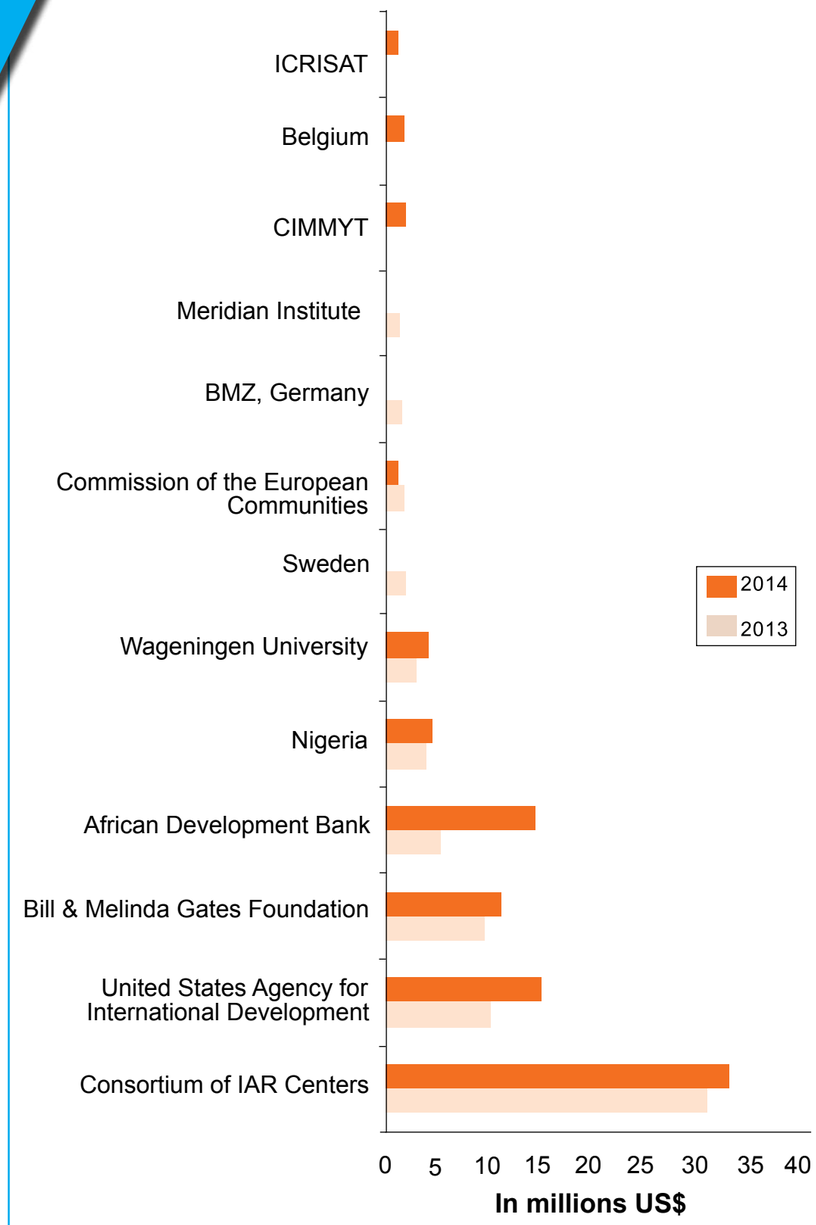


Table 1 shows IITA's 2014 investment by CGIAR Research Program. Table 2 reflects our financial health indicators; and Table 3 lists investors in 2013 and 2014.

Table 1. 2014 Investment by CGIAR Research Programs ($'000).

Title	W1/W2	Window3/ Bilateral projects	Total	W1/W2	Window 3/ Bilateral projects	Total
Humidtropics	15,000	20,734	35,734	15,016	17,067	32,083
Policies, Institutions & Markets	615	420	1,035	615	466	1,081
MAIZE	2,254	10,563	12,817	2,254	12,035	14,289
Roots, Tuber & Bananas	7,100	25,635	32,735	6,608	18,069	24,677
Grain Legumes	3,613	5,304	8,917	3,613	7,253	10,866
Nutrition and Health	2,855	8,237	11,092	2,969	5,231	8,200
Water, Land & Ecosystems	236	7,383	7,619	236	7,269	7,505
Climate Change (CCAFS)	1,252	2,140	3,392	1,252	1,115	2,367
Genebanks	1,020	172	1,192	1,020	172	1,192
CRP	33,945	80,588	114,533	33,583	68,677	102,260
Unrestricted /NCRP	-630	4,730	4,100	2,440	3,476	5,916
	33,315	85,318	118,633	36,023	72,153	108,176

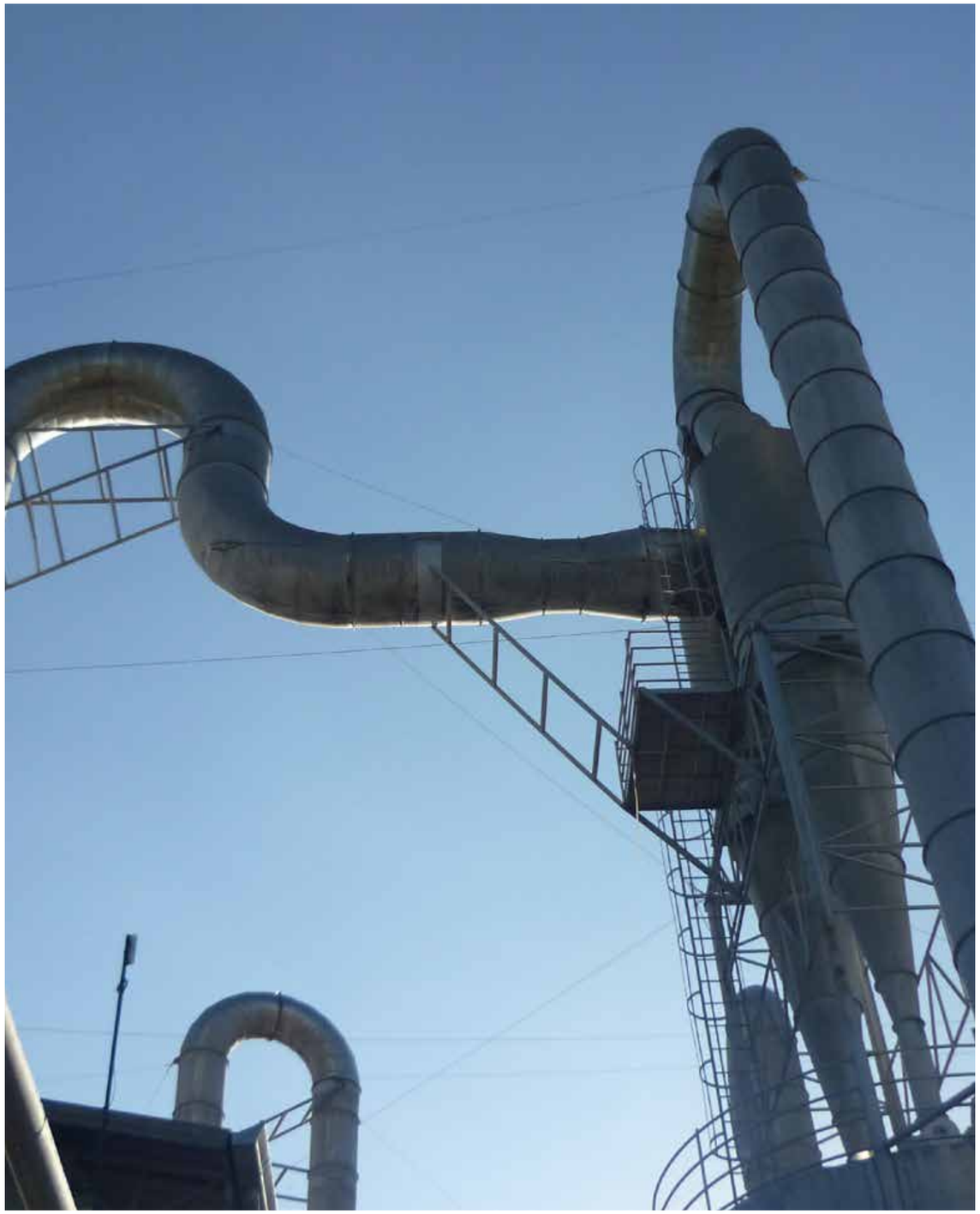
Table 2. Performance Indicators: Financial health.

	2013	2014
Short-term solvency (or liquidity)	44 days	37 days
Long-term financial stability (adequacy of reserves)	44 days	37 days
Indirect Cost Rates	16.69%	18.61%
Cash management on restricted operations	0.51	0.30
Audit opinion	Unqualified / Clean bill of financial health	

Winnowing groundnut in Senegal. Photo by IITA

Table 3. List of IITA investors.

	2013	2014
Investors	(in thousand US$)	
ACD/VOCA	40	-
African Agricultural Technology Foundation	66	44
African Development Bank	5,365	14,599
Catholic Relief Services	91	88
Chemonics International	24	-
CIMMYT	1,755	1,999
CORAF/WECARD	288	-
Commission of the European Communities	1,860	1,279
Common Fund for Commodities	1,122	822
Cornel University	742	851
Consortium of IAR Centers	31,341	33,583
Deloitte Consulting LLP	-	506
Denmark	111	24
DDPSC	-	-
DRC	-	1,011
Food and Agriculture Organization	93	91
France	330	330
GIZ	0	995
Global Crop Diversity Trust (GCDT)	393	173
icipe	58	13
ICRISAT	1,237	1,287
Illinois University	-	168
International Fund for Agricultural Development	354	1,200
IFPRI	548	552
Ireland	101	43
Japan	1,244	1,196
Leventis Foundation	115	75
L`Union Economique et Monetaire Quest Africaine	-	-
Meridian Institute	1,436	-
Nestle	-	-
Netherlands	427	1,262
Niger	-	352
Nigeria	3,994	4,656
Norway	0	-
Purdue University	37	292
Rockefeller Foundation	500	-
Sierra Leone	468	238
Sweden	2,097	1,054
Switzerland	505	231
United States Agency for International Development	10,389	15,297
Wageningen University	3,116	4,306
WASCO	-	-
World Bank	42	-
Miscellaneous Projects	2,478	3,831
Challenge Programs	785	986
Grand total	**86,303**	**108,703**



IITA HEADQUARTERS, HUBS, AND STATIONS

HEADQUARTERS AND HUBS

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