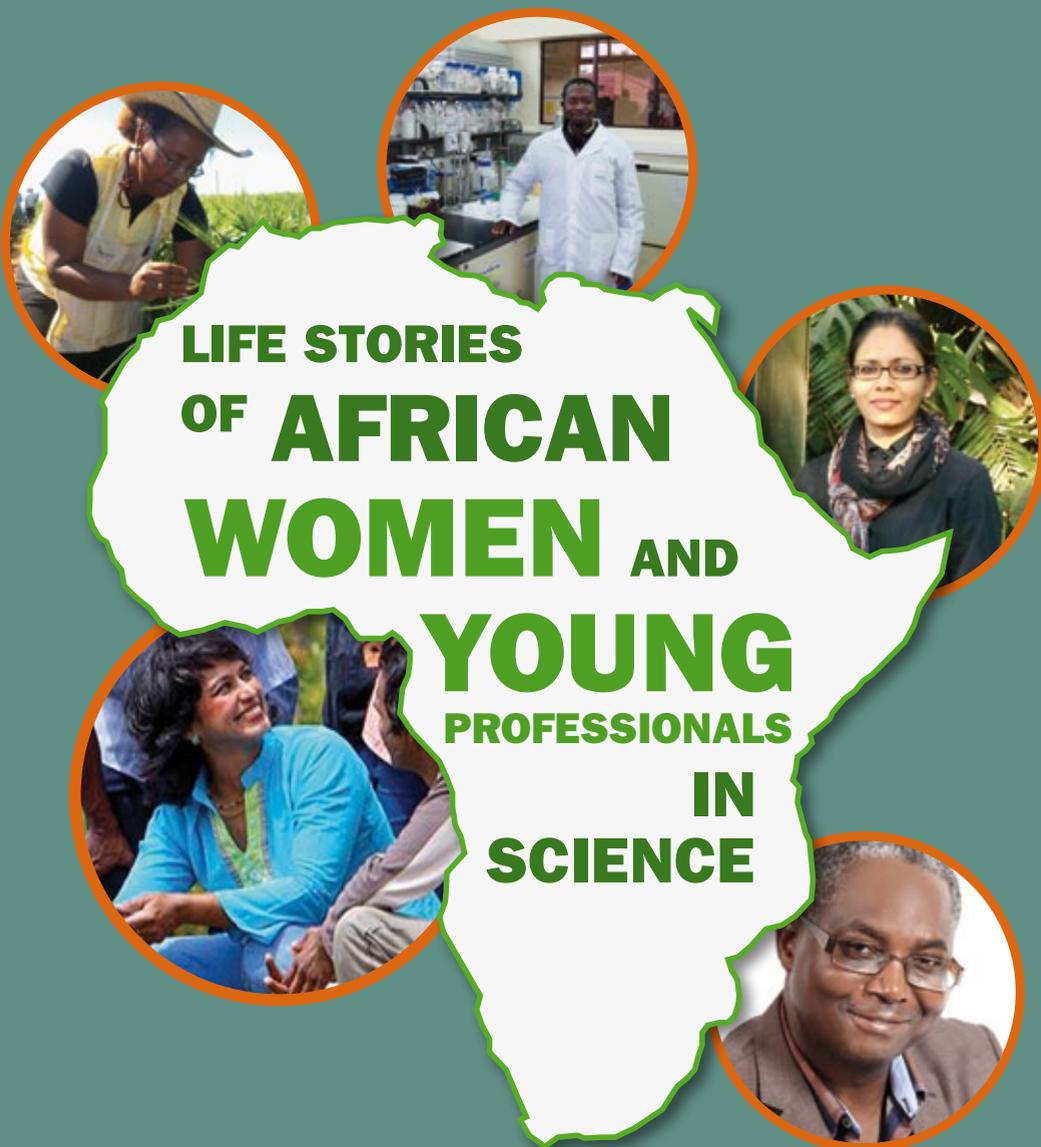


# Agricultural innovations for sustainable development



3<sup>rd</sup> Africa-wide  
Women and Young Professionals  
in Science Competitions



Agricultural innovations for sustainable development

# **LIFE STORIES OF AFRICAN WOMEN AND YOUNG PROFESSIONALS IN SCIENCE**

3<sup>rd</sup> Africa-wide Women and Young Professionals  
in Science Competitions



**INTERNATIONAL  
FOUNDATION FOR  
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# Foreword

Africa needs more agricultural scientists, and in particular more women scientists. Since 2009, CTA, the Forum for Agricultural Research in Africa (FARA), IFS and other partners have jointly organised Africa-wide science competitions targeting women and young professionals in science to showcase their research and celebrate their successes. The 3<sup>rd</sup> Africa-wide Science Competitions held in 2012/13 brought to light 10 extraordinary African scientists – seven women and three men, seven of whom were under 40 years old. They are inspiring individuals with a clear vision of how they will contribute to agricultural development and economic transformation in Africa.

The winners have travelled far and worked hard to achieve their early-career goals – some have come from small farms, through primary and secondary schools, to universities – and now have begun to reap the rewards of their efforts. For the women scientists, in particular, the journey has at times been arduous, breaking stereotypes of women's capacity to engage in science and balancing their career aspirations with their family commitments. Many of the scientists started their journey with aspirations to become a doctor, lawyer or mathematician. But for various reasons, they changed course to pursue careers as agricultural scientists. They all enjoy their research and teaching assignments and they are thrilled every time they see farmers using the results of their research. They value their collaboration with

colleagues and enjoy participating in international agricultural research networks, as well as the prestige gained in winning awards and gaining recognition for their research.

The 10 winners of the Africa-wide Science Competitions have benefitted from having role models who were a source of inspiration and strength in their science journeys. Now, they themselves are role models in their own right. In this booklet, we profile their life stories and those of two other leading African scientists to provide a source of inspiration for aspiring young scientists in Africa and beyond who might be considering a career in agriculture. As one of the winners featured in this booklet said, 'If you want to transform your community and ensure people have enough to eat, agricultural science is the career of choice.' We strongly concur with that view of the power of science and innovation in transforming the lives of rural communities. The combined Africa-wide Science Competitions targeting women and young professionals is a small but strategic effort to shine a light on those promising African individuals who are using science and innovation to improve the lives of smallholder farmers.

We hope you will enjoy reading the stories of these 12 remarkable African agricultural scientists who are making a difference on the continent and internationally.

Michael Hailu, Director of the Technical Centre for Agricultural and Rural Cooperation (CTA)  
Graham Haylor, Director of the International Foundation for Science (IFS)

# Introduction

Africa needs a critical mass of experts in Science, Technology and Innovation (STI). It will only transform its agriculture and food systems and boost socio-economic development once it gives more people, women and youth in particular, access to higher level education and starts to harness their potential.

Making agricultural research a high priority will also attract more skilled professionals to the field, and especially motivate women and young people. It is important to encourage those who receive training in agricultural science and related disciplines to then pursue careers in the field. There are different strategies for achieving this goal, including advocacy, targeted policies, capacity building, mentoring and promoting role models.

In 2009, CTA, FARA and partners organised the 1<sup>st</sup> Africa-wide Science Competitions targeting women and young professionals in the agricultural sciences. IFS joined the partnership in 2011. The competitions have sought to evaluate, recognise and reward the contributions of women and young professionals who are involved in:

- Pioneering and innovative research, technology development and engineering;
- Communicating their research results and technological developments to improve agricultural performance, enhance livelihoods and build resilience in African communities; and
- Advocating for policy change and influencing policy processes through their research, education and outreach programmes to transform the

agricultural and rural sectors, reduce hunger, improve prosperity and sustain the natural resource base.

The competitions emphasise the importance of investing in scientific research and the education of African women and young professionals for sustainable economic development. Success in these areas requires firm commitment from policy and decision makers and adequate financial support.

The 3<sup>rd</sup> Africa-wide Science Competition in 2012/13 promoted excellence in science and innovation in agriculture, with a focus on its socio-economic impact. The competitions identified and recognised outstanding women and young researchers who are engaged in communicating knowledge, technologies and new approaches to farmers and other key agricultural stakeholders, as well as advocating policy change to optimise the benefits from scientific and technological developments. The competitions resulted in the selection of ten extraordinary African scientists: seven women and three men, five of whom were under the age of 40.

This booklet takes a look at these remarkable women and young researchers who are motivated to be part of the solution, and not the problem. Indeed, as researchers they are helping to transform agriculture by developing science-based solutions to some of the complex issues facing African farmers. Their journeys to becoming agricultural scientists are strikingly similar: most of them come from smallholder farms, and their flair for science was spotted and nurtured by their



LINEAIR / JORGEN SCHYTE

secondary school teachers. Most of them wanted to become doctors or lawyers, but for various reasons had to pursue studies in agricultural science. Female students in particular lacked role models who could help them persevere in a male-dominated student environment. All worked hard, had some luck along the way and often had to balance their family duties with their studies and scientific careers. None of these women regret having become agricultural scientists. On the contrary, without exception they enjoy their work and the opportunity to nurture their talent and to contribute to the development of Africa's agricultural sector.

Africa faces the enormous challenge of increasing food production without further depleting the soil, water, and other natural resources. This challenge will require a great deal of ingenuity and focused scientific effort. It will rely on the capacity of the scientific and engineering community to develop new and improved crop and livestock varieties to combat

pests and diseases, and technologies to improve production and processing efficiency and reduce post-harvest losses. And it will require farmers and scientists to make better use of limited resources and to communicate about the importance of science and technology in agriculture.

It will also require intense scientific cooperation, communication and efficient extension. Indeed, this effort must be driven by a strong and empowered cadre of African scientists, researchers, engineers and institutions who can develop and adapt the scientific and technological innovations best suited to the African context and which can enhance long-term productivity.

CTA, FARA, IFS and partners, AGRA, ANAFE, NEPAD Agency and RUFORUM are honoured to be in a position to contribute to the aforementioned fields and encourage and support women and young researchers to pursue rewarding careers in science and technology in Africa.

Nighisty Ghezae, the International Foundation of Science (IFS), Stockholm, Sweden  
Judith A. Francis, the Technical Centre for Agricultural and Rural Cooperation (CTA),  
Wageningen, the Netherlands

# BRIGHT FUTURE FOR WOMEN SCIENTISTS IN AFRICA



Africans must be activists – not pacifists – in generating ideas, spurring research and mobilizing scientific knowledge for socially-relevant development purposes.

Ameenah Gurib-Fakim, Centre for Phytotherapy Research Ltd. (CEPHYR), Mauritius

In 1979, after sitting her A-levels, Ameenah Gurib-Fakim consulted the careers guidance office in Mauritius and was advised against studying chemistry at university. 'I was told there would be no career opportunities after my studies, and was reminded of my gender.' Thirty-five years later, Ameenah is a leading expert in the field of phytochemistry and the isolation of natural compounds from plants and the Chief Executive Officer of the Centre for Phytotherapy Research Limited (CEPHYR Ltd.), Mauritius. She previously held the positions of pro-vice-chancellor and was the first woman professor at the University of Mauritius with a Chair of Organic Chemistry. She is also the first woman to have served as Dean of the Faculty of Science and Deputy Vice Chancellor. She sits on the boards of countless science institutes and was

awarded the L'Oréal–UNESCO Women in Science prize in 2007, the Bank One Ltd Emma Award and the Economic and Social Council Award in 2008. She was selected as the leading role model for the Africa-wide Women in Science competition in 2009 and received a DSc from the Pierre Marie Curie University (Sorbonne Université), France in 2013. There can be no better role model for young female researchers in Africa.

Ameenah feels privileged to have pursued chemistry despite the odds and to have chosen areas – organic chemistry and medicinal plants – which were deemed irrelevant at the time. This was largely due to her parents' support and meant lots of sacrifices on their part, as education was neither free in the 1970s, nor was it a priority for girls. Having

chosen to read chemistry, she went to England to pursue her BSc at the University of Surrey in 1983 and her PhD in organic chemistry at the University of Exeter in 1987. 'After my PhD, I was all set to do a postdoc in the US but chose to return to Mauritius where I applied my research training in organic chemistry to a completely new area, phytochemistry. This shift was vital to my career because I could be productive academically at home, in one of the world's unique hotspots of biodiversity.'

In 2009, Ameenah founded CEYPHYR Ltd., a contract research organisation, which belongs to a holding of companies doing clinical trials for the pharmaceutical and cosmetic industries. This move from academia to business allowed her to build on her earlier pioneering research career and engage in the commercialisation of research outputs. Mauritius, located in the Indian Ocean, is one of the biodiversity hotspots in the world. 'This setting is important as it shows that even small island developing countries like Mauritius have comparative advantages; their own "Green Gold". It also shows that research and development work is

possible in Africa and enables us to engage in product development as opposed to being a net exporter of raw materials.'

Being at the top of her scientific career and an advisor to many international scientific committees, Ameenah is shaping the new agenda for research, innovation and entrepreneurship. In October 2014, she unfolded her ideas on how such a new agenda can be realised at the CTA International Forum *Unleashing science, technology and innovation for food and nutrition security*, in Arnhem, The Netherlands. She identified the following elements, which should be part of such a new agenda: (i) capitalise on the momentum gained in global environmental and conservation movements (*recognise all actions are local*); (ii) emphasise the maintenance and sustainable use of 'natural capital' (*recognise the important role of local communities*); (iii) mobilise cutting-edge knowledge (*recognise the value of indigenous knowledge and cultural traditions*); and (iv) forge partnerships anchored in the common good for the benefit of all (*become the voice of change*).



## YOU CAN DO IT TOO



My story brings to the fore the wise old saying among Africans that it takes a village to raise a child. It took the efforts and support of many people for me to be where I am now. To them all I say a big thank you.

Luke Mumba, the New Partnership for Africa's Development (NEPAD), Johannesburg, South Africa

Luke Mumba likes to tell secondary school students who are considering a career in agricultural science: 'Go and distinguish yourself. No agriculture graduate will ever be unemployed. In fact you don't have to look for a job, you can create your own and be self-employed. Be an ambassador for agriculture.'

Luke is Programme Coordinator of the African Science, Technology & Innovation Indicators (ASTII) initiative and oversees the New Partnership for Africa's Development's (NEPAD) efforts to improve the quality of STI policies across the continent. Perhaps best known in Africa and beyond for his advocacy of biotechnology and biosafety, Luke strongly believes that biotechnology, if prudently applied, could help address Africa's many development challenges. He argues that it will be difficult to provide food security without the contribution of

agricultural biotechnology. Africa needs crops that grow rapidly, use less water and fertilizer, and can resist pests and diseases. But alongside the application of biotechnology, Africa needs to build its capacity to assess and monitor the use of the technology to ensure its safety for humans, animals and the environment. 'I have promoted this view in Zambia and other African countries. In 2001, I established the Biotechnology Outreach Society of Zambia, through which we influenced the introduction of a Biosafety Act in Zambia in 2010.' It may be less well known that Luke has also trained more than 1,000 professionals in agriculture-related fields at the University of Zambia, many of whom are now championing agricultural development programmes in Zambia and beyond. 'Most of them are hard-working, conscientious leaders in their fields, and I am very proud of their achievements.'

Luke grew up in a township 15 km south of Lusaka, Zambia's capital, and was the first member of his family to go to university. His mother owned a *kantemba*, a roadside market stall where she sold home-grown fruits and vegetables. She made sure that he and his siblings never went hungry and gave each of them a chance to go to school. She even borrowed money from family and friends to top up her savings so she could pay for his school fees and other requirements, such as books and uniforms.

At secondary school, Luke's mathematics teacher soon spotted his flair for sciences and encouraged him to choose science courses. At the time he was admitted to university, higher education was still free in Zambia. With a government scholarship that covered accommodation, meals and a monthly stipend, for Luke university was like staying in a hotel. He completed his BSc in 1985 and on account of his outstanding performance he was offered the position of Staff Development Fellow by the University of Zambia and was able to pursue further training abroad, at the University of Wales in Swansea, UK, where he obtained an MSc in molecular genetics in 1987. Four years later, the Beit Trust granted him a fellowship to study for a PhD in plant genetics at the University of Cambridge, which he completed in record time in 1994.

Luke's academic career began when the University of Zambia offered him the post of Lecturer II in 1987. As he quickly rose through the ranks, he discovered and nurtured two of his many other talents – networking and science administration. After a period as Assistant Dean, he became Head of Department and later, in 1999, Dean of the School of Natural

Sciences and member of the University Senate and Council. Shortly after his promotion to Associate Professor in 2006, Luke took a prolonged leave of absence from the university to join NEPAD, first as the Regional Network Director of the Southern Africa Network for Biosciences (SANBio) and later in 2012, as ASTII's Programme Coordinator. It is unlikely that Luke is close to ending his remarkable career.

Africa urgently needs many more university trained agricultural professionals, scientists and science administrators as well as agri-business entrepreneurs. To achieve this, Luke recommends that today's university administrators start affirmative enrolment action to attract more students to study science and agriculture-related subjects. They could do this by creating dedicated quotas for science students taking agriculture courses, providing incentives such as scholarships, awards and internships, and inviting specialists in various science and engineering domains linked to the advancement of agriculture to serve as role models and to talk about their careers. 'I have made a career in science and agriculture and you can do it too.'



# A SCIENTIST WHO DOUBLES AS AN ADVOCATE FOR DEVELOPMENT



Agricultural science lets you live out all your passions. A degree in agricultural science enables you to develop and promote new and green agricultural technologies and practices that will help feed the world.

Nafiisa Sobratee, University of KwaZulu-Natal, Pietermaritzburg, South Africa

Winning first prize in the 3<sup>rd</sup> Africa-wide Women in Science competition gave Nafiisa Sobratee the platform to showcase her passion – an African PhD graduate in agricultural science who is working to solve pressing needs in the developing world. Nafiisa was interested in life sciences from an early age, but the realisation that she could build a career in agricultural science grew during her field visits to farming communities near the Drakensberg Mountains in South Africa. There, while assessing farmers' knowledge of conservation agriculture she realised that much more could be done to feed Africa.

Born in Mauritius, Nafiisa obtained her bachelor degree in agricultural and environmental sciences from the University of Mauritius. After graduating she obtained a scholarship from the Tertiary Education

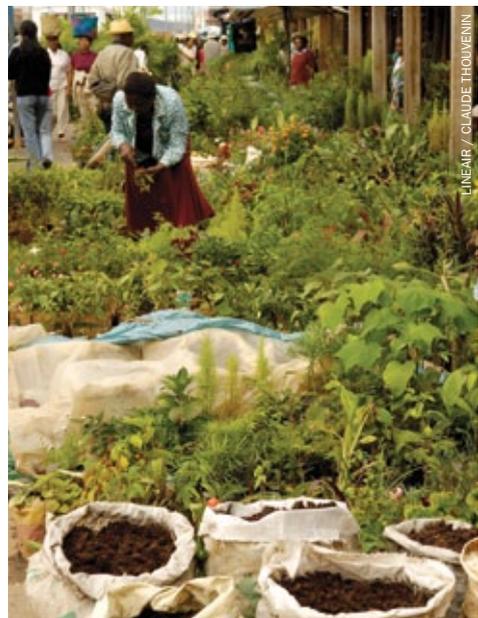
Commission of Mauritius to go directly for her PhD in bio-resources management at the same university, which she obtained in August 2011.

Nafiisa won the first prize in the Women in Science competition with her research, which demonstrates the capacity of the composting process to transform poultry litter into a safe product to replenish the organic matter content of soils. The most relevant outcome of her research, she believes, was the identification of the weak points in composting systems, in terms of sanitation, that allow bacterial pathogens to proliferate during the process. 'Optimising composting practices as a component of both conservation agriculture and conventional farming is one of the solutions to African's soil fertility crisis.'

Nafiisa always welcomes challenges to test the limits of her own scientific abilities, as happened during the question time following her presentation of her research findings for the competition finals at the FARA's 6th Africa Agriculture Science Week in Accra, Ghana, in 2013. 'I had to convince agricultural scientists of the African diaspora about the significance and correctness of my findings.' At the time of the call for participation in the Women in Science competition, she had just completed her PhD and thought it would be her best chance to share the results of her research with fellow competitors and to learn about advocacy for enhancing agricultural and environmental science in Africa.

As a young student in agricultural science, Nafiisa's role models included Françoise Driver, who encouraged her to read beyond her textbooks and stressed the importance of demonstrating critical analysis during exams and later in peer-reviewed publications. Another role model was Romeela Mohee, a pioneer in compost engineering and her principal PhD supervisor, who shared her vast international experience with her research students. Now, having won the Women in Science competition and well on the way to becoming a successful scientist in her own right, Nafiisa hopes to become a role model herself for young women who are considering a career in agricultural science. Nafiisa urges students to 'share', 'like', 'add' or 'follow' national and global developments in agricultural science. 'University students should think and express themselves freely through their own blogs and social media, and engage in civic action with the aim of bringing food security to Mauritius, Africa and the world.'

Nafiisa hopes that she will be able to use her growing reputation as an agricultural scientist to challenge Mauritius government officials about the progress achieved in the Maurice Ile Durable (MID) project. Launched in 2008 by Prime Minister Navinchandra Ramgoolam, this project aims to transform the environmental, economic and social landscape of Mauritius and to make the country a world model of sustainable development, particularly in the context of Small Island Developing States. She plans to ask the government to what extent, after six years, the universities have empowered their graduates to become the country's future leaders with an MID vision, and whether agricultural and environmental scientists and engineers can actually obtain secure jobs to drive the MID vision. 'Without proper academic training and scientific success no one would have listened to me, but now they may.'



## A FEMALE AGRICULTURAL ENGINEER ON WOMEN'S EMPOWERMENT



Joining courses dominated by males is challenging. But here is a word of encouragement for all my sisters out there: know yourself and go for what you are good at no matter what the world thinks.

Florence Lubwama Kiyimba, National Agricultural Research Organisation (NARO), Uganda

When Florence Kiyimba left home to go to university, her parents told her to 'go and make us proud', which is just what she did. After she obtained her MSc in agricultural engineering at the University of Nairobi, Kenya, in 1997, she joined Uganda's National Agricultural Research Organisation (NARO), where she is now a senior research officer. While at NARO she began her research and obtained her PhD from Wageningen University and Research centre, the Netherlands, with a thesis entitled *Tools for Women's Empowerment? The case of the forage chopper for smallholder dairy farmers in Uganda* in 2011. This research also won her second prize at the 3<sup>rd</sup> Africa-wide Women in Science competition in 2013.

'Gaining my PhD involved a journey that made it difficult to balance family and

career, and required me to make some sacrifices in the family life I hold so dear.' Based on her experiences – a period of hard work and the success she enjoyed at the end of it – Florence advises girls at secondary school that they too can excel in chemistry and mathematics, areas where men have always dominated. 'Work hard and always be focused on the bigger goal of your life'. Meanwhile, she is discussing with government and university officials how girls can be encouraged to embrace and maintain their interest in the sciences during and in particular after their training at university.

There are not many female students reading agricultural engineering. 'Unfortunately, I had no role model during my university time that I could look up to. But I had already been shaped by the

teachers of my girls-only secondary school. They taught me that what boys could do we girls could do too, that we should stand for what we believed in, and more importantly never give up. I am now the only female engineer among men and I do equally well as my male colleagues.'

Florence's research focused on gender aspects in the design and development of a forage chopper to reduce the workloads of women smallholder dairy farmers. She considers the most relevant outcome of her research the understanding that the effectiveness of these machines depends on social structures and support facilities within households and communities. Taking a participatory approach to the technology design process, she decided, together with the principal users, the women, that the chopper needed to be redesigned to incorporate simple adjustments and modifications that would make the machine easier and safer to operate. She found, however, that introducing a labour-saving device targeted at women is in itself not enough to guarantee that women will benefit from it, let alone be empowered. She encountered unanticipated dynamics related to the artisans and welders who make the machines, and concluded that the empowerment of women with labour-saving tools requires a design process that is grounded not only in engineering but also in the social and material contexts of their households.

Florence is building professional networks with other women in science and engineering to advance women's empowerment efforts with technology. The African Women in Agricultural Research and Development (AWARD) offered her a scholarship to network and

bring together women scientists and engineers and thus enabled her to work closely with like-minded professionals. She is now writing research proposals that can draw on the expertise of interdisciplinary and multi-institutional teams from such professional networks to respond to the production constraints of smallholder farmers.

Most of the innovations Florence and her colleagues at NARO are working on have been the result of sharing knowledge with people facing similar challenges and using similar farming systems. 'Changing mind-sets takes a while but with more effort we can impress on the men who have never even talked to female farmers or seen them at work the need to focus on their needs so that agricultural interventions will benefit those who carry out most of the production activities – namely women.'



HEIFER / RUSSELL POWELL

# AN INSPIRATION FOR ASPIRING BIOTECHNOLOGISTS



At my MSc graduation ceremony, my supervisor told me that I had all it takes to be successful and that I should not regard the sky as my limit but as my starting point!

Ijeoma Akaogu, National Biotechnology Development Agency (NABDA), Abuja, Nigeria

Ijeoma Akaogu won the third prize in the 3<sup>rd</sup> Africa-wide Women in Science competition with her pioneering research on extra-early maize hybrids with combined resistance to Striga and drought tolerance during the flowering and grain-development periods. The prize made her an instant celebrity at her research institute, the National Biotechnology Development Agency (NABDA) in Abuja, Nigeria. The International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria, where she is now a research fellow, reported on the prize in its worldwide newsletter and the *Daily Trust*, one of Nigeria's national newspapers, soon picked up on the story. Within a short time, seed companies started to bang on her office door to learn more about the candidate varieties she had identified during her research.

Yet Ijeoma's first desire was to be a medical doctor. She applied twice to study medicine, but without success. She then pursued agricultural science with enthusiasm and today has no regrets. 'On the contrary, my research is challenging as well as rewarding and my colleagues are excited about my work and achievements. I have visited advanced laboratories in the United States and Europe, and have attended international conferences where I have met wonderful people who are now part of my international network. Friends who have studied medicine and law are jealously calling me the "tourist" and want to join me at NABDA.'

Ijeoma's interest in science began at an early age. After having obtained her BSc in plant science and biotechnology at Imo State University, Nigeria, she continued to

study for an MSc in agronomy (plant breeding major) at the University of Ibadan, Nigeria, with the support of the Alliance for a Green Revolution in Africa (AGRA). She is now reading for a PhD at the West Africa Centre for Crop Improvement (WACCI) of the University of Ghana. 'My father always encouraged me to pursue a university education and promised to pay for my training to any level. He believed that a good education was the best thing he could give his daughter and he fully supported me during my undergraduate studies at Imo.' During her studies, several people provided valuable encouragement, in particular the late Victor Ibigami, former director of NABDA's agricultural department, whom she met during her national youth service at the institute. 'He was a wonderful man who inspired me by sharing his own life experiences. He was convinced that if people could feed themselves well, they would not become ill and would not need to see a doctor – at that time I had applied for a second time to study medicine at the University of Nigeria.'

Her IITA supervisor, Baffour Badu-Apraku, liked to challenge her to become a scientist like him. 'But not all of my supervisors were always so friendly; they could sometimes be very severe. Often, after a long day of lectures, they would send me out into the field, since in their view plant breeding is done in the field and not in the classroom. You tend to start appreciating your supervisors only later in life.'

Ijeoma considers her time at university as a challenge, but one she would not have missed for the world. 'I remember struggling to combine my research work, which included multi-locational trials in

Nigeria, with the course work, where a 70% attendance rate was needed to be allowed to sit for the examinations. While I was doing my field trials, my friends kept me posted about what was happening in the lecture halls. But all the hard work was well worth the effort. I was able to draw on part of the research I did at university for the Women in Science Competition, and the rest is history.'

Ijeoma always tells students who are just beginning their studies that a degree will give them the freedom to pursue their dreams and that out there in the labour market, it is the survival of the fittest, so a good grade might well make all the difference. 'I always emphasise that they should refrain from joining cults: that could ruin their lives. I tell them that they are Nigeria's leaders of the future, and the country depends on them.'



# ANIMAL BIOLOGIST SUCCEEDS WHEN FARMERS BENEFIT



Girls should never think that a scientific training at university is too long and that a scientific career is something for men only.

Clémentine Dabiré-Binso, Institut de l'Environnement et Recherches Agricoles (INERA), Burkina Faso

In May 2014, Clémentine Binso was elected to the Technical Management Advisory Committee of the Feed the Future Legume Innovation Laboratory at Michigan State University, East Lansing, USA. At her first committee meeting she felt very emotional as she looked back on the long and often difficult road from her village in Burkina Faso to the meeting room where the other committee members applauded her. Clémentine admitted to herself that she was getting used to such accolades. A year earlier, FARA's General Assembly had applauded her when she won the 4th prize in the 3<sup>rd</sup> Africa-wide Women in Science competition.

At a very early age, Clémentine already knew that she wanted to contribute to the development of the rural area where she grew up. 'As a child I loved pottering

about on my uncle's farm; he was an agricultural technician who taught me the practical ins and outs of farming.' So when her family encouraged her to pursue a career in agricultural research, she did not have to think twice and enrolled at the University of Niamey in Niger to study animal biology. In those days, there were not many secondary school students who wanted to go to university, so if you were qualified it was easy to obtain a government scholarship. It must be said that these scholarships were not very generous, so every summer I had to get a job to top them up.'

After completing her BSc degree, Clémentine went to France to continue her studies at the University of Bordeaux where she obtained her MSc in animal biology in 1976. 'That was a really tough

time for me. I felt guilty when my family and friends in the village said that I was spending too much time studying, and I also had serious problems adjusting to the climate and social environment in France. Despite that, I continued my studies at Pierre and Marie Curie University – Paris VI and defended a doctoral thesis in agricultural entomology in 1980.’ In September 1980, the Institut de l’Environnement et de Recherches Agricoles (INERA) recruited Clémentine as agricultural entomologist and in 2001, while still at INERA, Clémentine was awarded a PhD in agricultural entomology by the Université de Cocody, the former Université Félix Houphet Boigny, in Abidjan Côte d’Ivoire.

At the university, Clémentine particularly liked the practical sessions such as dissecting animals, which she always found fascinating. ‘At the time, those sessions embodied for me what was the essence of science – the search for proof and evidence.’ Then there were of course the professors, in particular the female professors, who have always been her role models. She just wanted to be one of them. Many supervisors supported her along the way and advised her to just grin and bear it when she had those low moments that all students inevitably experience during their studies. ‘They urged me to remember that, in the end, success in my work would be useful for the farmers in my village.’

Her persistence paid off. Clémentine now is a senior research scientist with the African and Malagasy Council for Higher Education (CAMES) at INERA in Burkina Faso. She likes to tell secondary school students contemplating their options at university that nothing will make them

more proud than to see farmers using agricultural innovations that they helped to develop. ‘Every time that happens to me, I feel very excited.’

Clémentine won her prize at the Women in Science competition for her success in developing triple bagging technology for storing cowpeas. She designed the technology after years of rigorous laboratory testing at INERA. She is now regarded as the expert on triple bagging and on good practices for storing agricultural products, and is frequently consulted on issues related to technical capacity building among women in agriculture. ‘This recognition should serve to encourage all women who are devoting their time and efforts to science for agriculture. It has given me confidence to commit myself even more to supporting smallholder farmers, especially women, to help them improve their livelihoods. I also hope to convince my government and universities to create more opportunities for girls to pursue university training in agricultural science.’



## A SCIENTIST WHO PROMOTES AGRICULTURAL ENTREPRENEURSHIP



We should drop the notion that agriculture is a useless, unprofitable career: for those who are training and educated, agribusiness and agricultural science are profitable income earners.

Fredah Karambu Rimberia, Jomo Kenyatta University of Agriculture and Technology, Kenya

Fredah Rimberia grew up on a small farm in the central highlands of Kenya. Her parents grew coffee, tea, vegetables and had some dairy cattle. They always encouraged her to find ways of fighting the pests and diseases on their farm and to look for a good job in Nairobi in order to escape the continuous struggle against poverty in the village. At secondary school she excelled in science subjects, and her geography and biology teachers advised her to pursue a science-related career. 'To convince me, they pointed to former students of the school who had become doctors and extension workers and were now doing well in their careers.' Like many, she wanted to become a doctor or horticulturalist after completing her high school exams. In the end, Fredah enrolled in the horticultural programme of Egerton University, Kenya's premier agricultural university.

Like so many other female agricultural scientists in training, she struggled with the fact that at university there were no female study supervisors. After her graduation she joined Jomo Kenyatta University of Agriculture and Technology, where she met a female senior staff member who had encountered the same macho environment but had persistently pursued her PhD degree. She was a source of inspiration and encouraged Fredah to continue her studies and read for a PhD degree in agricultural science. 'I could combine my family duties and scientific career because I am blessed with a very understanding husband who is very supportive at home.' But it was her PhD supervisor, Professor Shinichi Adaniya of the University of the Ryukyus, Japan, who became her principal role model as a scientist and who instilled in

her the discipline that is required for hard work in research and publishing in scientific journals. 'After five years in his laboratory in Japan I can deal with any research challenge.'

Fredah enjoys being an agricultural scientist at a public university. It not only provides her with an income, but also the chance to interact with like-minded scientists in Kenya and beyond and join international collaborative research projects. She is fascinated by result-oriented research, when farmers can use the findings from her work to solve real problems on their farms. The research for which she was rewarded the fifth prize in the Women in Science competition was a good example. 'The most relevant result of my research was the finding that the production of clean and healthy papaya plantlets of known sex can solve farmers' inability to differentiate among the papaya's 3 sex types at the seedling stage. I found that healthy orchards with a correct mix of one male to nine female plants will greatly increase the fruit yields compared to current combinations based on farmers' guesswork.'

Fredah keeps in touch with her home base in the central highlands. She has

noticed that her former teachers at her secondary school are now using her as role model for those students who are not sure whether to enrol in university or any other professional training. She is sometimes asked to talk to them and always tells them to opt for further training to prepare for venturing into agribusiness and creating jobs for themselves and other young people. 'I always emphasise that they should not sit back and feed on other people's efforts.' And she advises those who are talented in one or more academic subjects to seek out opportunities for postgraduate training and to become lecturers or agricultural scientists. 'Raising funds for your university training cannot be an obstacle. The government provides loans to pay for your fees and other expenses during your BSc training. And like me, you can get funding for further study from multiple national and international sources, provided you make deliberate attempts and don't give up after failing a number of times.' And she advises her former secondary school teachers and university officials to 'introduce courses in agricultural entrepreneurship and make them compulsory for all students, both in secondary schools and in universities'.



ALAMY / ECHO

## YOUNG SCIENTIST BREEDS NEW WHEAT VARIETIES



Students often consider agriculture to be not cool. However, anyone who delves deeper into the science of agriculture will discover that it is really an exciting area to explore and enjoy.

Jemanesh Kifetew Haile, Ethiopian Institute of Agricultural Research, Addis Ababa, Ethiopia

Women have built up successful careers in agricultural science in Africa. Jemanesh Haile, from the Ethiopian Institute of Agricultural Research (EIAR) in Addis Ababa, is one of them, and she credits her husband for her academic success. ‘My husband is one of those model African men who encourage women to develop their own careers. During my periods of absence for my study he takes care of our kids. If it had not been for him, I would never have achieved my scientific goals.’

In 2010, with four other young female scientists, Jemanesh won the Jeanie Borlaug Laube Women in *Triticum* (WIT) Early Career Award for women working on wheat in the early stages of their careers. And in 2013, she was awarded the first prize in the Young Professionals in

Science competition with her study to identify quantitative trait loci (QTL) that confer resistance to stem rust in Ethiopian durum wheat. The results of her research have made useful information on stem rust genes and QTL available specifically to Ethiopian wheat breeders.

Jemanesh entered the Young Professionals in Science competition because she saw the event as a way to contact other young African scientists. She also thought that winning a prize in such a competition would advance her career and open up opportunities for new research projects that would improve the livelihoods of African farmers. ‘But it is not this prize, or the WIT Early Career Award, but the practical benefits farmers receive from my research on stem rust

resistance that are encouraging me to continue my career in agricultural research.'

Most of Jemanesh's family, including her parents, are farmers. The returns from their farms are hardly sufficient to support them. 'One of my childhood dreams was to see Ethiopian farmers using improved seeds and other inputs.' When she left secondary school and went to university she entered a world that was totally new for her. 'Understanding science was perhaps the easiest part of that transition; the social and cultural barriers I encountered as a female student were much more of a struggle to overcome.' Initially, her family was unhappy that she wanted to study agriculture at the university. 'They told me that I didn't need to be educated to be a farmer like them. I am glad that they have come around after seeing what I have achieved. My brothers Alemu Kifetew and the late Bayu Kifetew helped me through this very difficult time at home'

Directly after my BSc, I joined EIAR as a junior researcher in the national wheat improvement programme, where I had the opportunity to focus on various elements of wheat research, from collecting local varieties from farmers to generating improved wheat cultivars and developing farm management practices. 'After two years with EIAR, I went back to Addis Ababa University to do my MSc in genetics. At this point, I decided that I wanted to study abroad to learn more about modern plant breeding techniques and methods.'

In late 2008, Jemanesh got a scholarship from the German Academic Exchange Service to do a PhD in gene and genome

mapping at the University of Kassel in Germany in collaboration with the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK). 'There I met Marion Röder, currently leader of the Gene and Genome Mapping group at PIK, Gatersleben, Germany. She not only became my supervisor who helped me through my four-year PhD study and research, but also became my role model. She is an inspiring and very talented scientist who relentlessly devotes all her time to science.'

Currently a postdoctoral fellow in the Crop Development Centre at the University of Saskatchewan, Canada, Jemanesh would like to encourage secondary school students in Ethiopia to choose options that lead to careers in agriculture. 'There are many exciting opportunities for further study to improve agricultural productivity and enhance food security in my country.'



## A SUCCESSFUL SCIENCE CAREER MEANS NEVER GIVING UP



The keys to a successful scientific career are to never give up, to recognise an opportunity when it presents itself and make the most of it. It gets better and better as you go higher.

Stella Kabiri, Mukono Zonal Agricultural Research and Development Institute (MUZARDI), Uganda

Stella Kabiri is a crop scientist at the Mukono Zonal Agricultural Research and Development Institute in central Uganda. Her career has progressed smoothly, in spite of an initial setback when she failed her university entrance exams. But she drew inspiration from Nelson Mandela, who endured 27 years in prison to later become president of South Africa. She repeated her A-levels and was admitted to Makerere University in Kampala to read agricultural science.

At Makerere University, Stella quickly discovered that there is a general misconception that studying agricultural science only involves training to work on a farm. 'So I was ready to break some sweat, only to discover that agricultural science encompasses many different disciplines, such as crop science, animal science,

agricultural economics and extension education.' She also experienced the gender disparities that still exist among students at many African universities. 'Out of a class of 92 students, only 18 of us were women. One day a male student told me, in the presence of my classmates, that I was going to fail my course work. I was stunned at first, but soon it became clear to me that irrespective of gender, all students were equally smart, intelligent and ambitious. And I won second prize in the 3<sup>rd</sup> Africa-wide Science Competition for Young Professionals, not him. The first prize in that competition was won by a woman too.'

Stella had entered the competition because she saw an opportunity to raise awareness of the risks posed by *Cymbopogon nardus*, commonly known as muteete grass, an aggressive invasive

species that is rapidly encroaching on large areas of Ugandan rangeland. Muteete grass produces pungent and volatile essential oils, and she discovered that these can be used to control *Cyperus rotundus*, another invasive grass that is affecting crop production across Africa, and so could be used as a cheap and environmentally friendly alternative to chemical weed and pest control. 'Winning second prize in the competition really looks good on my curriculum vitae, but solving problems and discovering something that no one else has found before are much more rewarding than winning a prize. Those are the reasons why I trained to become a scientist.'

At the start of her career, she observed that many male respondents were 'prodigiously overweight' while their wives were 'so frail and thin you could think chocolate had been poured on their bones.' She decided to find out why. It turned out that most households had just one cow that produced half a litre of milk, which would be taken by the man while his wife and children nibbled on leftovers. Also, the women did the bulk of the farm work. On another occasion, she met a widow with six small children 'sitting around a meal that looked like it was their last dinner. Such women not only need programmes that contribute directly to poverty eradication, but also policies that promote their social and economic empowerment. My life's purpose became clear from these two experiences, and I decided to get myself a more holistic education so that I could make a meaningful contribution to improving the lives of the rural poor.'

Stella had no problem obtaining funds for her university training and research. At the time the government of Uganda sponsored

the 2,000 students with the highest scores in their pre-university exams, and she was one of them. Later, during her training, she realised that there are many international funding opportunities in the field of agricultural science. 'You just have to find them. And since there are few women scientists there is always a good chance to be selected.' Indeed, she received two scholarships from the Dutch government, one to study for an MSc in natural resources management at the University of Twente's Faculty of Geo-information Science and Observation (ITC), and another to read for a PhD at Wageningen University, which she expects to obtain in 2015.

Asked what advice she would give to the authorities in Uganda and other African countries, Stella explains that she would urge government officials to encourage girls at secondary school to study science subjects, and universities to introduce short courses on agricultural entrepreneurship for rural farmers. 'There is so much knowledge in universities that does not reach the rural poor. Universities depend on their graduates to deliver this knowledge. But graduates have to find jobs, and often those jobs do not link them to poor farmers.'



## SCIENTIST BREAKS NEW GROUND: HEAT-TOLERANT LOCAL CHICKENS



Agricultural science covers many areas one can venture into. Studying agriculture at university does not mean missing out on opportunities. I am a living proof of that.

Julius Kofi Hagan, University of Cape Coast, Ghana

Agricultural science should be reintroduced as a compulsory subject in Ghana's primary and secondary schools. Universities should make courses in agricultural science more practical in order to enable graduates to start their own agri-businesses. And the government should offer special scholarships for young women who wish to read agricultural science at university in order to boost the number of female agricultural scientists.

These are three pieces of advice that Julius Hagan, lecturer at the Department of Animal Science at the University of Cape Coast's School of Agriculture, would give to Ghana's government and universities. He was awarded third prize in the 3<sup>rd</sup> Africa-wide Young Professionals in Science competition for his research on

the introduction of heat-tolerant genes into exotic chicken breeds as a way to improve egg production in warm and humid environments.

Julius describes himself as a self-motivator who is determined to break the poverty cycle in his family and decided that the only way to do so was to study hard. At secondary school he read the life stories of the great mathematicians, inventors and scientists and decided to go to university to become a mathematician. But he was not admitted to read mathematics because his secondary school did not offer pure science subjects, so he followed the agricultural science programme. 'Agricultural science really was a consolation prize. But I have never regretted it.'

In his first year at university, Julius formed study groups to make up for his lack of background in subjects such as organic chemistry and physics, and he read beyond the lecture notes provided by his teachers. He worked during the holidays to pay his tuition fees, accommodation and living expenses, and he only sought financial support from his family and friends when he was not earning enough. He was employed by the University of Cape Coast as a senior research assistant and ended up receiving a scholarship to do a PhD at the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana, which he received in 2010.

The main output of his research – for which he was awarded the third prize in the Young Professionals in Science competition – was the development of chicken breeds that can be highly productive in the hot and humid environments of the tropics. He covered most of the research costs himself, with additional support from his PhD supervisor and a scholarship. ‘In Ghana, all young researchers first need several years of experience and exposure before they can reach the position where they can raise funding for their research.’ Winning the third prize and subsequently having the results of his research being selected by CTA as one of its Top 20 agricultural innovations that is benefitting smallholder farmers have changed all this. This acknowledgement has provided international recognition and opened doors for collaboration all over the world. ‘The publicity that comes with winning these awards has boosted my professional image. Everybody seems to know me now, and my academic career has moved ahead much more quickly.’

Looking back, Julius never imagined that he would come as far as he has. ‘OK, maybe being an agricultural scientist is not financially rewarding, but I am anything but unhappy, because teaching and research are my passions. They asked me to present a paper on behalf of my country to the world’s most eminent animal breeders and geneticists at a conference in Brazil. As a poor village boy who has struggled to make a living, this was an emotional experience.’ He would like to impress on students in secondary school and those enrolled in agricultural colleges and universities that agriculture is the mainstay of African economies, yet it is a barely exploited area and as a result presents today’s students with numerous opportunities. Agricultural science is a broad field, and there are so many areas one can venture into. ‘Studying agriculture at university does not mean missing out on opportunities. I am a living proof of that.’



# A DEDICATED RESEARCHER AND COMMUNITY ACTIVIST



LINEAIR / PASCAL DELOCHE / GOODING

Agricultural science is based on mathematics, chemistry and life sciences. If you wish to read agricultural science at university, make sure you take A-level courses in these subjects.

Komi Edem Koledzi, University of Lomé, Togo

Edem Koledzi is one of a rare breed of scientists who has actually implemented the results of his own research. In his early years at the University of Lomé, Togo, he began to wonder why sophisticated urban waste processing plants with expensive imported technologies in his country were either at a standstill or operating at reduced capacity, costing the government lots of money every year. At the University of Limoges, France, he therefore decided to investigate solid waste chains and the associated compost production systems in Lomé, from households to agricultural fields, for which he received his PhD in 2011. Meanwhile, alongside his research work and with the help of ENPRO, a local NGO operating a door-to-door waste collection service, he was instrumental in establishing an urban waste-sorting

platform and composting unit where he applied and tested the findings of his own research.

Edem is equally proud of his PhD and the success of his composting project. 'Compost producers and farmers both benefit – the compost is sold to farmers who use it on their fields instead of chemical fertilizers to maintain and even regenerate the fertility of their farms.' The composting project currently processes 20 tonnes of urban waste every day and employs a staff of 35. Recently, international NGOs such as the GoodPlanet Foundation became involved to help the plant to become financially sustainable by 2015.

Edem's research and his urban waste-sorting and composting plant have also

attracted the attention of the international agricultural science community. He has published articles in peer-reviewed journals, and has been invited to international conferences to present the results of his research and discuss how he has applied them to boost compost production. In 2013 he was awarded fourth prize in the 3<sup>rd</sup> Africa-wide Young Professionals in Sciences competition.

Edem considers the award for his research recognition that even simple adaptations to existing technologies can help Africa feed itself. As a scientist, he combines a keen interest in formulating hypotheses and developing scientific protocols to prove them right or wrong, with a passion for transferring the technologies he develops to practical use. 'I always feel genuinely excited working with the ENPRO people in applying my technologies to large-scale, low-cost compost production and going out to the villages to talk with farmers and convince them to replace expensive chemical fertilizers with much cheaper and equally effective compost.'

The results of Edem's research have often been contrary to common wisdom. He is a modest scientist, and as a student he has struggled to confront his supervisors and peers with research findings that no one expected. However, the international science prize has brought recognition with it, and he is now much more confident about speaking out, not only about his own work but also to students who want to become agricultural scientists like him. He often gives secondary school students the following advice: 'Agricultural science is based on mathematics, chemistry and life sciences. If you wish to read agricultural science at

university, make sure you take A-level courses in these subjects.' He likes to tell students that they are living in a globalised world but that 'they should not blindly follow the latest trendy ideas promoted through social media. They should follow their own intuition, develop their own talents and learn as quickly as possible how to set up and implement their own research projects.'

In Togo, Edem has now become a strong advocate for turning waste into compost to replace chemical fertilizers. He is challenging his government to stop subsidising chemical fertilizers and instead to start supporting the production of equally effective and much cheaper compost, and to launch campaigns to encourage farmers to use it. 'We have demonstrated to the mayor of Lomé that our way of collecting urban waste and composting the organic material it contains saves the city lots of money. It makes sense to recycle these savings and invest part of them to produce organic fertilizers from the waste we produce.'



# RING-FENCE BUDGETS FOR AGRICULTURAL RESEARCH



Almost all middle-income people end up retiring to work on their farms. Why not start young instead of coming to it when you are tired and ‘looking for a new life’?

Donald Kugonza, Makerere University, Uganda

Science, especially its practical aspects, had always fascinated Donald Kugonza, so going to university after high school was a logical step. ‘When I was a child, on holiday on a farm away from the hustle and bustle of the town, I decided that I wanted a career working with livestock’. He can talk with great enthusiasm about his aunt’s dairy farm where he lived after his father died when he was just ten years old, and about his years at high school where he did well in agriculture, even though the subject was frowned on by his classmates.

Donald studied at Makerere University in Kampala, Uganda, and graduated in animal science. He obtained his PhD in animal breeding and genetics at the same university. While studying the work of Mendel and Darwin he kept true to his

roots and continued to grow tomatoes, cabbages and aubergines on his student allotment. At Makerere he met Professor Gabriel Kiwuwa, who not only taught him animal genetics but also took him under his wing. ‘He called me son and I really felt he filled the position of dad that had been vacant for so long. I admired his command of animal genetics and breeding, and still do.’

Donald pursued several options to support his university training. He won a number of scholarships: one from the government of Uganda to study for his BSc degree, a second from DANIDA (Danish Aid) for his MSc, and another from NORAD (Norwegian Aid) for his PhD, which covered the tuition fees, research costs and his living expenses. He notes that ‘support for animal science is very

limited across the world, but once I had identified a potential funder, obtaining a grant was quite easy.’ The quality of his research, as well as the compelling passion with which he talks about his work, have opened many doors for him.

Donald has had a rewarding university career. ‘I enjoy my research and the associated teaching. I am also doing consulting work, both in Uganda and in neighbouring countries.’ He travels widely in Africa, as well as to Asia, Europe and the United States. ‘Last year I attended the 2013 World Food Prize award ceremony in Des Moines, Iowa. I will not quickly forget sitting next to Marc Van Montagu, the man who discovered the Ti plasmid, part of the genetic equipment used by bacteria such as *Agrobacterium tumefaciens* and *A. rhizogenes* to transfer their genetic material to the nuclei of the plants they attack. I have been fascinated by this phenomenon throughout my career. I can’t imagine there is anything else I would enjoy more than scientific research and teaching.’

Donald strongly believes that Uganda should fund its agricultural research from its own revenues. He is convinced that the government should ring-fence funding for crop and livestock research. Currently, 80% of his own research is funded by international research organisations such as the Competitive Grant Scheme of the National Agricultural Research Organisation (NARO) in Uganda, RUFORUM (Regional Universities Forum), and the Lake Victoria Research Initiative of the Inter-University Council of East Africa. He hopes that the Ugandan government will take its responsibility soon and replace these agencies as the principal financier of his research.

Donald won the fifth prize in the Young Professionals in Science for his research on pigs. Winning this prize and gaining publicity has opened doors for him. For example, NARO invited him to become a member of the advisory panel to the National Livestock Resources Research Institute in Entebbe. ‘Sitting on this panel together with two eminent scientists has really helped my career’.

With his contagious enthusiasm he is keen to offer advice to secondary school students. ‘Choosing a career in agriculture will bring you accomplishment. If you want to transform your community and ensure that people have enough to eat, agriculture is the career of choice. And if you are interested in making money, a career in agriculture will get you there too, although perhaps not as fast as you might wish.’



# Future prospects for science and innovation in Africa

Africa remains fully committed at the highest policy level to the deployment of science, technology and innovation (ST&I) for its socio-economic and agricultural development. Yet agriculture in Africa has a PR problem; it is generally linked with poverty, drudgery, long working hours and low wages. That said, agriculture will remain Africa's most important productive sector, especially as urban markets expand. It has the potential to absorb Africa's young professionals; on farms, in agri-business, in the food, cosmetic and pharmaceutical industries, in trade and logistics, and in research, teaching and training.

Today, agriculture in Africa is experiencing a renaissance, which the life stories of these twelve remarkable African men and women agricultural scientists confirm. They are trailblazers and their efforts are improving the quality of farm produce, making crops and livestock more resilient to climate change, transforming technology development by making it more inclusive and gender sensitive, and enhancing agribusiness and trade. They are science and engineering champions for whom the sky is not their limit but their starting point.

By 2050, 40% of the world's youth will be African. Future generations need to be educated and their energies focused on productive activities. Parents are prepared to invest in their children's future and will spend every spare penny to enrol their

children in primary and secondary schools, and in many cases universities. But African governments need to engage their home-grown talents with the necessary know-how and understanding of the local context. If Africa is to 'make poverty history', they must continue to invest in creating an enabling environments for a new cadre of 'ST&I champions'.

The twelve agricultural scientists portrayed in this booklet are successful scientists. They all remained modest and well aware that it took the support of their families and village communities to be where they are now. But they are also devoted to agricultural innovation. They lead, or will soon lead, national and international policy debates on agricultural innovation systems, food and nutrition security, biotechnology, nanotechnology and the battle to stem the impact of climate change on agriculture. But most of all, they are role models for the next generation, who by their example can become better students, defend what they believe in and more importantly never give up.

Africa needs a critical mass of highly motivated, well-trained, skilled and committed scientists. The life stories in this publication demonstrate that there is a foundation on which Africa can build. Let these and other committed scientists serve as the launch pad for future generations.

Judith A. Francis, Technical Centre for Agricultural and Rural Cooperation (CTA),  
Wageningen, the Netherlands



# About this publication

This booklet takes a look at the life stories of twelve remarkable African agricultural scientists who are making a difference on the continent and internationally. Ten of them are the women and young researchers who were winners of the 3<sup>rd</sup> Africa-wide science competitions. They are motivated to be part of the solution, and not the problem. Indeed, as researchers they are helping to transform agriculture by developing science-based solutions to some of the complex issues facing African farmers. Their journeys to becoming agricultural scientists are strikingly similar: most of them come from smallholder farms, and their flair for science was spotted and nurtured by their secondary school teachers, their families, captivating mentors and generous role models.

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