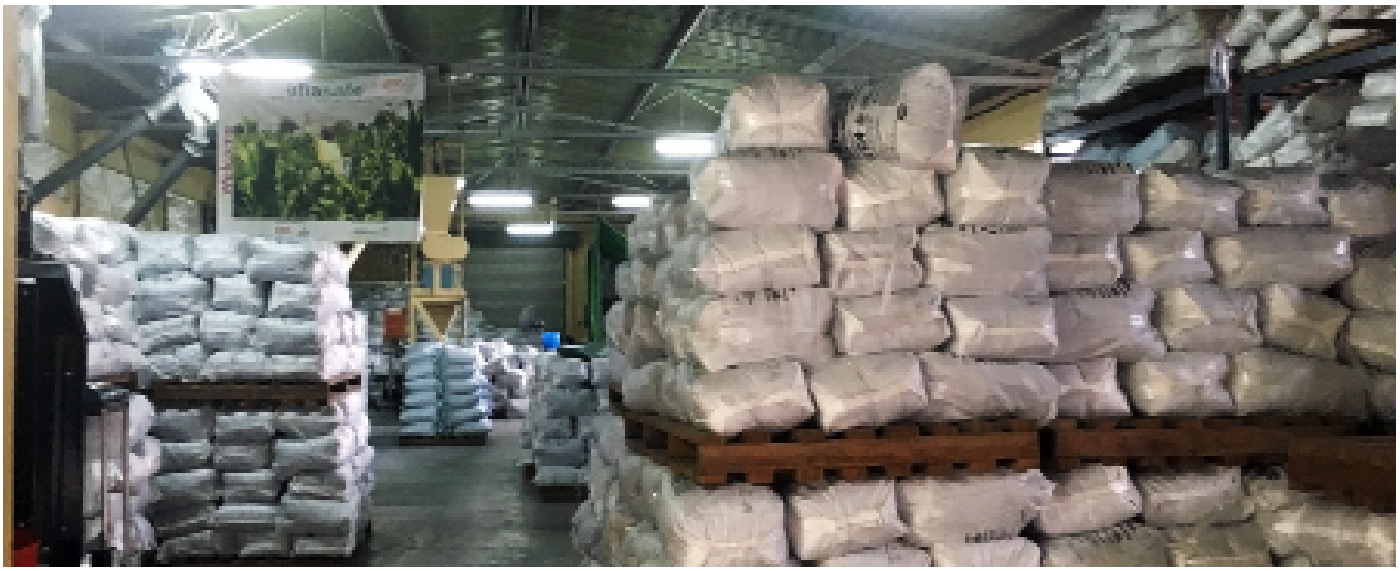
IITA
Transforming African Agriculture
CGIAR

IITA news

No. 2515 25–29 November 2019

Decade-long trials prove efficacy of Nigeria's aflatoxin biocontrol product

An IITA-led partnership has honed aflatoxin biocontrol for sub-Saharan Africa (SSA) for over 15 years. Recently, the team published a landmark journal article reporting a 10-year study on the efficacy of Aflasafe®, a registered biocontrol product for aflatoxin management in Nigeria. This is the longest-running, most extensive study on the efficacy of any biocontrol product or management practice for aflatoxin alleviation. The study firmly establishes Aflasafe® as a vital tool in the fight against aflatoxins. to page 3



Aflasafe in the factory.

IITA launches International Year of Plant Health (IYPH) 2020

With decades of research contributing to the improvement of plant health globally and across Africa in particular, IITA joined the plant science community on 22 November to launch the International Year of Plant Health (IYPH) 2020. The IYPH 2020 is a year-long observance with the theme, "Protecting Plant Health in a Changing World" and aims to raise global awareness on how plant health can help end hunger, reduce poverty, and protect biodiversity and the environment.

INTERNATIONAL YEAR OF PLANT HEALTH 2020

The launch took place as part of the Institute's Research for Development (R4D) Week, and took into account the landmark contributions of the Institute in the area of plant health and agriculture in its over 50 years of research work in Africa.

The United Nations General Assembly declared 2020 as the Year of Plant Health recognizing the importance of healthy plants in addressing food security and sustaining life on Earth. The UN sees plant health as key to the sustainable development of agriculture to feed the growing global population by 2050. In line with this, the Institute is taking stock of the immense progress in the area of breeding resistant crop varieties as part of efforts to improve crop productivity, tackle food security and plant health research.

IITA began in 1967 with the founders—Ford and Rockefeller Foundations—targeting increased crop yields to meet the level of production required to supply the food demand in Africa. So in the earlier days, research focused on increasing productivity until nature played a nasty trick three years later.

In 1970, faced with the outbreak of the Maize Streak Virus (MSV) disease that could have entirely wiped out the maize crop, IITA's research focus turned to plant health without abandoning the yield objective. IITA and partners worked tirelessly to combat MSV and by 1985 high yielding cultivars and hybrids with different maturity classes, grain colors, and textures for different zones in Africa were released.

To breed these MSV resistant varieties, IITA together with the International Maize and Wheat Improvement Center (CIMMYT) and 36 national partners, got germplasm from Thailand, Central and South America. Because of this concerted effort to overcome MSV, in 1986, IITA got its first award in plant health—the CGIAR King Baudouin Award.

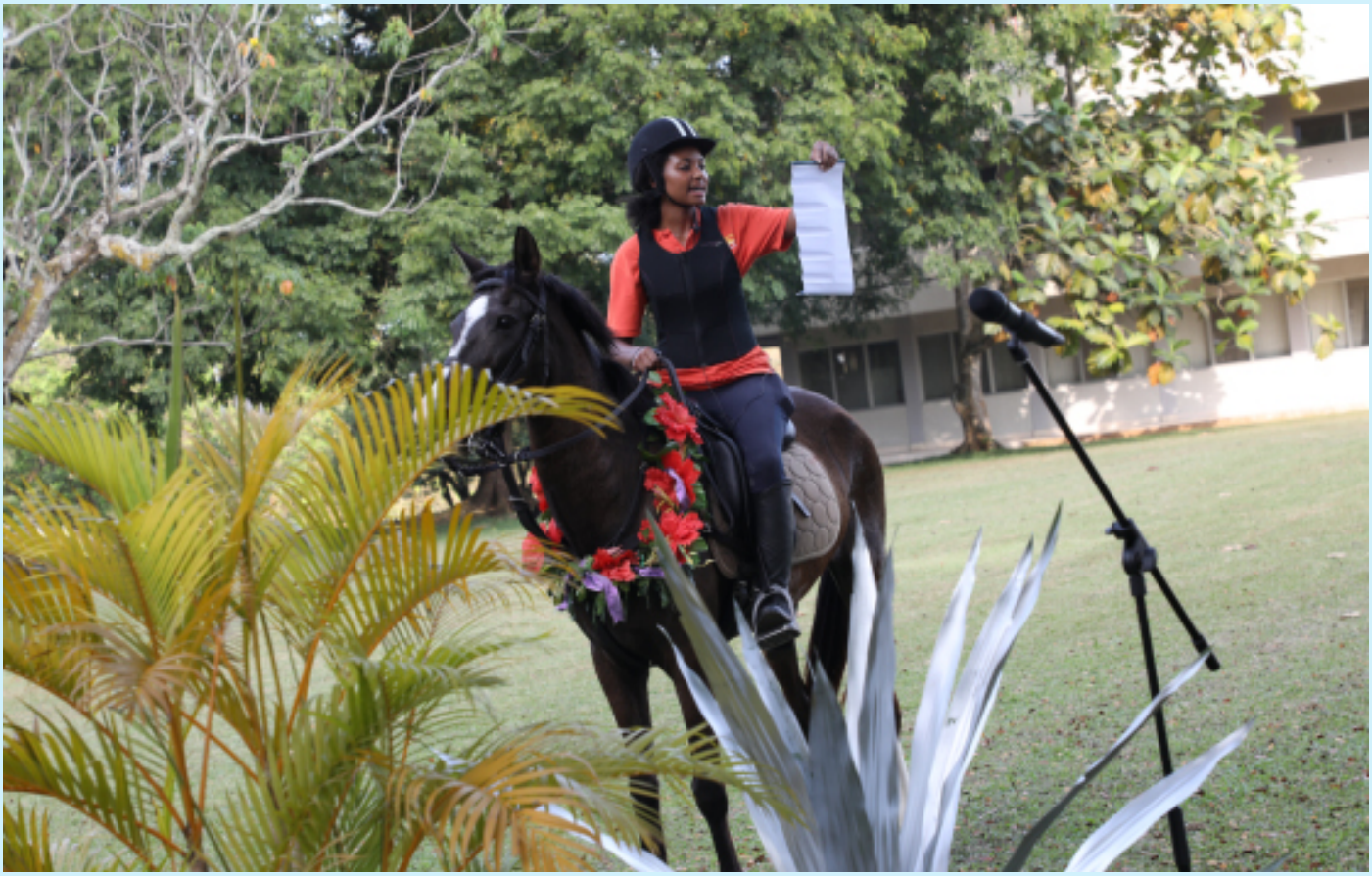
According to IITA Entomologist Georg Goergen, "Agriculture in tropical Africa is widely prevailing in a smallholder situation. In this context, biodiversity is often comparatively high and biotic stress such as insect pests and plant diseases are frequently challenging," hence the need to continuously research into ways to address these challenges.

Over the years, IITA recorded more successes in plant breeding research in Africa with numerous awards that have strengthened the Institute's commitment to plant health. The research from the Institute has cut across different crops culminating in multiple awards including the 2006 CGIAR Outstanding Senior Scientist Award to IITA Breeder Bahdur Singh, for breeding fast maturing "60-day" cowpea cultivars for the tropics as well as cultivars with resistance to more than 10 pathogens and drought and heat tolerance in other cultivars.

Biological control, which is the use of natural enemies to fight crop pests, was also adopted alongside resistance breeding. Biocontrol was first used in combating the cassava mealybug and cassava green mite using Apoanagyrus lopezi, a predator wasp. This wasp, from South America, is a natural enemy to the mealybug and green mite. It controlled the cassava mealybug wherever it was released. This was the first of many successes in biocontrol, this research breakthrough won the CGIAR King Baudouin Award in 1990, along with the International Center for Tropical Agriculture (CIAT) team.

With the recorded success in the use of the biocontrol, IITA opened a Biological Control Center for Africa in Cotonou, Benin, in the 1980s. This center has grown to become Africa's leading biocontrol research hub. Scientists from Cotonou have put their expertise to many pest challenges and surmounting them.

According to the UN resolution affirming this international year, the global science community is hoping that the celebration of the year would "encourage actions to promote and implement activities in favor of preserving and sustaining global plant resources, and raise awareness of the importance of plant health in addressing issues of global concern, including hunger, poverty, and threats to the environment."



A messenger from the FAO proclaiming 2020 as the International Year of Plant Health.

Continued from page 1

Decade-long trials prove efficacy of Nigeria's aflatoxin biocontrol product

Aflatoxin contamination of crops in SSA, especially maize and groundnut, is common. It has a profound negative impact on Sustainable Development Goals (SDGs) related to personal, social, economic, and national development opportunities.

People get exposed to aflatoxins through food, with devastating effects. It causes reduced growth and a weakened immune system in children while adults develop liver diseases and cancer. Exposure curtails animal productivity and generally, people and animals die if food/feed aflatoxin content is high. Income and trade sectors suffer too because farmers cannot sell crops contaminated above tolerance thresholds in premium markets. Aflatoxin contamination of crops in SSA, especially maize and groundnut, is common.

The aflatoxin biocontrol technology employs a deceptively simple natural principle: Raising the proportion of *Aspergillus flavus* strains incapable of producing aflatoxins (called atoxigenic) in a field lowers aflatoxin accumulation in crops produced there. This biocontrol technology increases the frequency of native atoxigenic strains in the field before the aflatoxin-producers become established, creating an aflatoxin-safe environment.

IITA scientists began the biocontrol technology development process together with the United States Department of Agriculture – Agriculture Research Service and national partners collecting more than 4,000 *A. flavus* strains from crops and soil in Nigeria in 2003. Through a well-designed but laborious selection process, four safe, competitive, and widely distributed atoxigenic strains native to Nigeria were selected. These four strains serve as active ingredients of Aflasafe®, the first registered natural aflatoxin biocontrol product for Africa and third globally. So far, 12 Aflasafe products have been developed and registered for use in nine African nations. Each contains four atoxigenic *A. flavus* active ingredients native to the target nation.

These active ingredients are coated on roasted, sterile sorghum, which is spread in fields while crops are developing. When conditions are favorable, the active ingredients grow on the sorghum and spread across the crop to outcompete aflatoxin producers that would otherwise dominate the field. This results in less aflatoxin-producers, which are displaced by the safe atoxigenic active ingredients. Treated fields contain significantly less aflatoxins—sometimes 100% less than non-treated crops.

Biocontrol products can be commercialized only after the product is registered by regulatory authorities following mandatory extensive efficacy testing, safety evaluations and demonstrated value in food/feed systems, and substantial interactions with regulators. Commercialization requires the development of processes and infrastructure to produce the biocontrol product, development of tailored commercialization strategies, and technology transfer to appropriate manufacturing and distribution partners. The emphasis on registration and scaling-up biocontrol to improve food safety, increase income, and enhance trade has resulted in the delayed publication of results of efficacy trials in peer-reviewed scientific journals. Lack of efficacy data in the public domain has caused ambiguous and sometimes negative perceptions about the effectiveness, adoption, and sustainability of biocontrol in African contexts.

Publications of efficacy trials and large-scale biocontrol adoption are now emerging after building a solid base for large-scale biocontrol usage in several nations. In October 2019, scientists from the Aflasafe initiative published the longest term study of an aflatoxin biocontrol product across the globe. The team reported on an extensive 10-year study that combined results of efficacy trials required for registration (two years) with data from both large-scale trials to demonstrate product value (two years), and commercial use by thousands of maize farmers (six years). The data from commercial usage came from aflatoxin analyses on more than 213,000 tons of maize harvested in 15 states in Nigeria by over 90,000 farmers who applied Aflasafe to their crops!

Nearly 95% of over 7,000 grain samples, each representing 30-ton grain lots, from treated fields had less than 10 ppb of aflatoxins. "It was a massive effort to collect samples from thousands of places and transport them to the lab, perform rapid aflatoxin analysis and microbiological/molecular tests, and report the results in a timely manner," says Adebowale Akande, Manager of the AgResults Nigeria Aflasafe™ Challenge Project.

According to Ranajit Bandyopadhyay, the lead author of the Nigeria study, "The results show that biocontrol is a stable, effective aflatoxin management tool for crops grown by smallholder farmers. In addition, the study provides evidence of large-scale adoption of the biocontrol product in Nigeria." The papers reporting efficacy of biocontrol in West Africa put to rest all doubts on efficacy, usefulness, and adoption of aflatoxin biocontrol for SSA nations.

"Very few peer-reviewed published studies have monitored the efficacy of biocontrol products against plant diseases on a continuous basis over a long-time horizon. These classical studies were primarily in crown gall and tree disease settings. The Nigeria aflatoxin biocontrol study can be counted among them and, to the best of my knowledge, is the most extensive among field crops," says Jürgen Kohl, a world-renowned biocontrol specialist from the Wageningen University & Research, The Netherlands.

In addition to the 10-year Nigeria study, other recent publications on the efficacy of biocontrol products include those on groundnut and maize in Senegal, chili pepper in Nigeria, and maize and groundnut in Ghana. These Open Access peer-reviewed journal articles show the efficacy of biocontrol in multiple environments, over several years, in diverse cropping systems, under a variety of challenges that smallholder farmers face in SSA. More studies will soon be published reporting biocontrol efficacy in Burkina Faso, The Gambia, Ghana, Kenya, Malawi, Mali, Mozambique, Rwanda, Tanzania, and Zambia, where Aflasafe products are being tested.

The large-scale use of biocontrol as a centerpiece of holistic aflatoxin management programs has the potential to significantly reduce hunger, malnutrition, poverty, unrest, and economic underdevelopment. These major impacts can help meet several targets of many SDGs.

Offloading Aflasafe from a truck.

IITA Scientist elected to prestigious global science body

Leena Tripathi, IITA Principal Scientist in Plant Biotechnology and the Deputy Director of IITA's Eastern Africa hub has been elected as a fellow to the prestigious American Association for the Advancement of Science (AAAS).

Tripathi received this recognition because of her distinguished contribution to developing robust genetic transformation platforms for banana/plantain, cassava, enset, and yam and the application of genome editing technologies for banana/plantain and yam. Tripathi and her team in Nairobi, Kenya, are currently working on banana resistance to bacterial wilt and banana streak virus (BSV) using CRISPR, a genome editing tool.

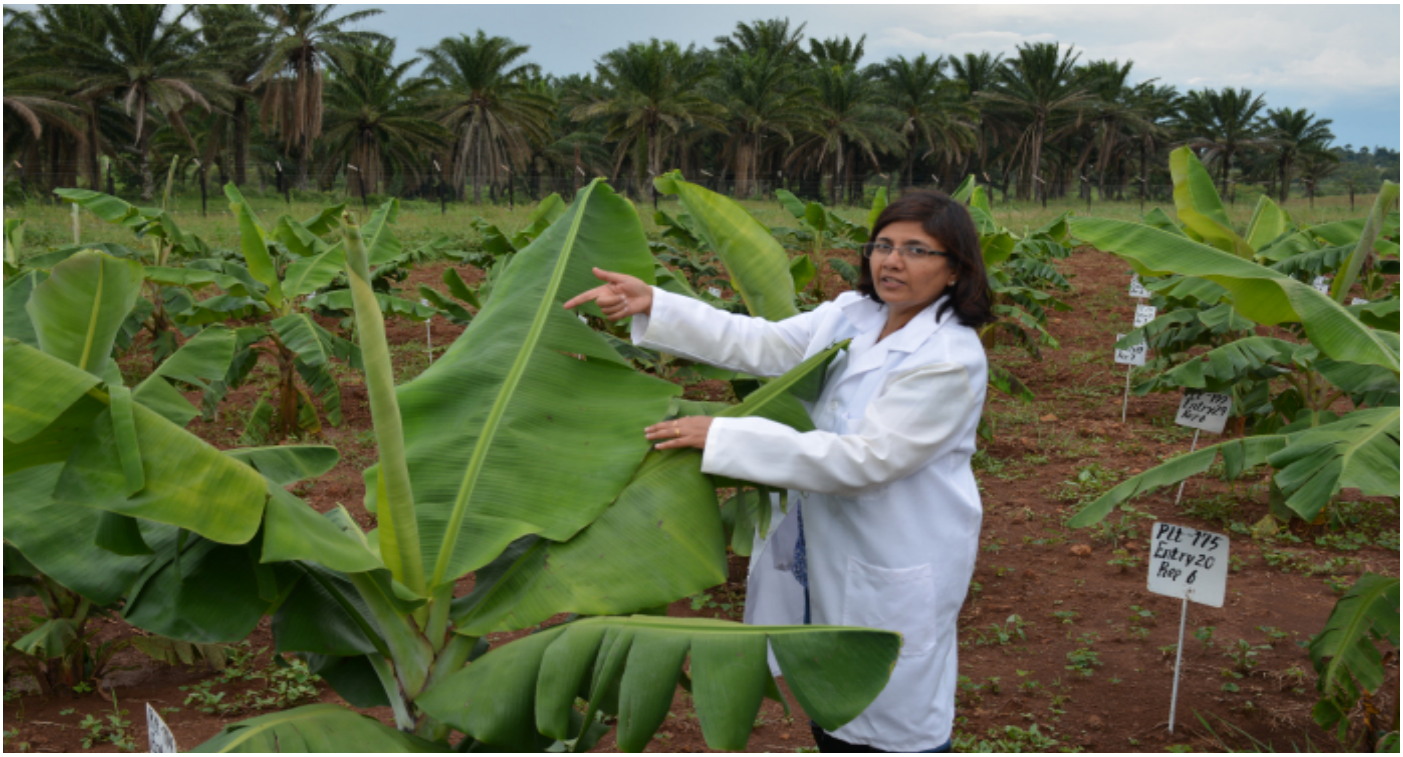
The letter relaying the news read, "On behalf of the Council of the American Association for the Advancement of Science, I am very pleased to inform you of your election to the rank of AAAS Fellow. Each year the Council elects members whose efforts on behalf of the advancement of science or its applications are scientifically or socially distinguished."

Becoming an AAAS Fellow is a lifetime honor, which comes with an expectation that the recipient maintain the highest standards of professional ethics and scientific integrity.

This year, 442 other members of the American Association for the Advancement of Science (AAAS) were awarded the distinction of Fellow. New Fellows will be presented with an official certificate and a gold and blue (representing science and engineering, respectively) rosette on 15 February, at the AAAS Fellows Forum during the 2020 AAAS Annual Meeting in Seattle, Washington, USA.

The tradition of AAAS Fellows began in 1874. Currently members can be considered for the rank of Fellow if nominated by the steering group of their respective sections by three Fellows, or by the Association's Chief Executive Officer. Each steering group then reviews the nominations of individuals within its respective section and forwards a final list to the AAAS Council.

AAAS is the world's largest general scientific society and publisher of the journal Science, as well as Science Translational Medicine; Science Signaling; a digital, open-access journal, Science Advances; Science Immunology; and Science Robotics. AAAS was founded in 1848. Read the full story on the new fellows here.



Leena Tripathi in a banana field.

Events

1st Aflasafe for Africa Conference, Arusha, Tanzania, 4–5 November
Food Security Synthesis Caravan Conference, IITA headquarters, 5 November
International Plant Protection Congress (IPPC) 2019, Hyderabad, India,10–14 November
5th Nutritious Food Fair, IITA headquarters, 13–15 November
Board Meeting and R4D Week, IITA headquarters, 18–22 November

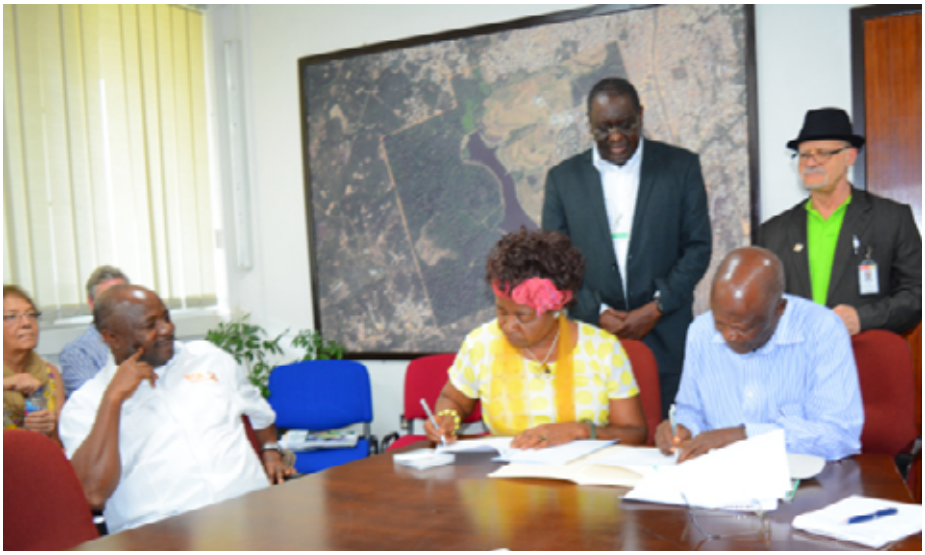
Radio IITA
Knowledge 4 Farmers

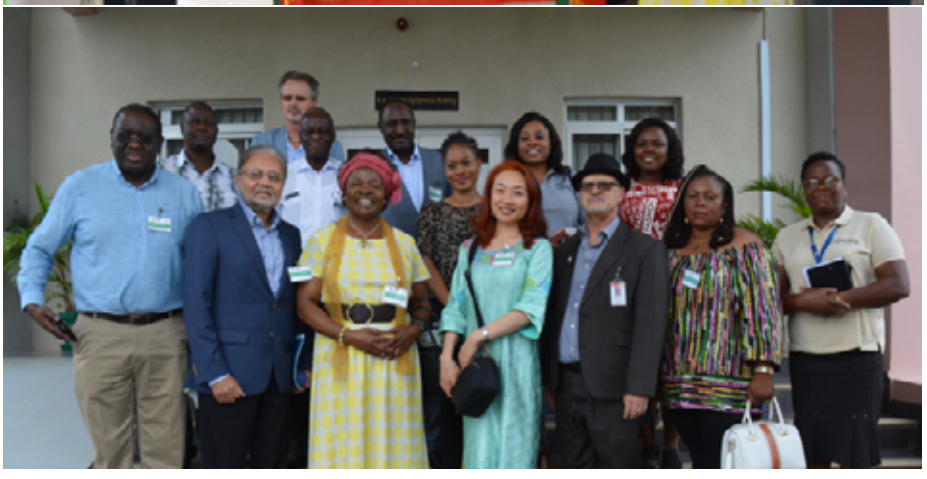
Got a story to share?

Please send your story with photos and captions every Tuesday to iita-news@cgiar.org or Katherine Lopez (k.lopez@cgiar.org) and Uzoma Agha (u.agha@cgiar.org) for headquarters and Western Africa, Catherine Njuguna (c.njuguna@cgiar.org) for Eastern and Southern Africa, and David Ngome (d.ngome@cgiar.org) for Central Africa.

Sasakawa Africa Association and IITA sign MoU to strengthen partnership

The Sasakawa Africa Association (SAA) team met with members of the IITA Board of Trustees (BoT) at IITA Ibadan campus on 20 November. The meeting was to sign a Memorandum of Understanding (MoU) to strengthen their existing partnership and discuss further partnership opportunities.





Top: SAA and IITA representatives sign MoU. Center: The Sasakawa team at the IITA-BIP facility. Bottom: The SAA team visits IITA Youth in Agribusiness (IYA).

Welcoming the SAA team, Amos NamangaNgongi, IITA Board Chair said, "It is good to have all of you here because of the serious business we have to do in Africa. We are working towards narrowing the gap between potential and actual and it is good that SAA is trying to increase productivity at the rural level." In agreement, Ruth Oniang'o, Chair of SSA Board said, "Africa is lagging behind in productivity and food security."

Mel Oluoch, SAA Regional Director highlighted why both organizations have a good basis for partnership. "SAA focuses on agriculture technology transfer, taking developed technologies to scale at the grassroot farmer level, while IITA generates technologies," he said. Although, the institutes have worked together on projects like N2Africa, Taking Maize Agronomy to Scale in Africa (TAMASA), and currently working on Africa Cassava Agronomy Initiative (ACAI), SAA is looking to strengthen the relationship with IITA through getting involved in more projects.

One major area of focus for SAA in partnering with IITA is youth empowerment. This is because both organizations are working to reduce migration of youth to the cities by creating jobs for them at the rural level. Through this partnership, SAA hopes to have proven technologies from IITA, which can be given to rural youth and will be a game changer in creating job opportunities for them.

After discussions and signing of the MoU, Kenton Dashiell, IITA DDG Partnerships for Delivery, appreciated the SAA team for visiting and said, "Even though we have a good partnership right now, there are many opportunities to strengthen it."

SAA was founded in Geneva in 1986 by Ryoichi Sasakawa with the vision to create a sub-Saharan Africa free of hunger and poverty, sustainably producing nutritious food in an eco-friendly, market-oriented, and socially viable system. The association seeks to achieve this by working in partnership with public and private stakeholders, particularly extension advisory services, to influence the inclusive transformation of African agriculture to sustainably increase productivity and income in response to market demand.