

Scientists successfully use gene-editing technology to develop first-ever plantain resistant to banana virus streak

A team of scientists have announced a major breakthrough in their efforts to develop improved banana and plantain varieties that are resistant to banana streak virus (BSV), one of the diseases hampering the crop's production in Africa and threatening the food and income of millions of farmers.

The team successfully used CRISPR, a powerful technology for genome editing, to develop plantain plants that showed high resistance to the banana streak virus. This is a widespread pathogen that develops chlorotic streaks on leaves that finally leads to death of the plant. This is the first report of generation of a genome-edited crop in Africa.

The breakthrough was reported in a paper 'CRISPR/Cas9 editing of endogenous banana streak virus in the B genome of *Musa* spp. overcomes a major challenge in banana breeding' published on Communications Biology website on 31 January 2019, [DOI: 10.1038/s42003-019-02](https://doi.org/10.1038/s42003-019-02)

Plantains, and their close relative banana, are important staple food crops in tropical and subtropical countries. However, their production is constrained by a myriad of diseases. The development of improved varieties that are resistant to diseases and pests is vital to ensure healthy and high yields, and for food and income security.

The banana streak virus works by integrating its DNA into the B genome of banana and plantain having one or more of the genome. When the plants are stressed – for example, by drought or heat, tissue culture – the viral DNA produces functional viral particles, ultimately causing disease symptoms. Thus, major epidemics caused by BSV are not due to natural transmission through insect vectors or through use of infected planting materials, but rather due to activation of integrated virus under stress conditions such as unfavorable conditions.

As a result, breeders avoid using banana and plantain that contain the B genome, like the *Musa balbisiana*, for crop improvement even though they may have positive attributes,



Plantain fruits.

such as hardiness, a strong root system, and tolerance to stress.

The research team, led by Leena Tripathi, Principal Scientist, at IITA based in Nairobi, Kenya, used the CRISPR/Cas9 system to inactivate viral DNA from the B genome of *Gonja Manjaya*. The *Gonja Manjaya* is a variety of false horn plantain of the *Musa* genus commonly grown in East and Central Africa.

The genome edited plants of *Gonja* were generated and tested by Jaindra Tripathi, a Banana Transformation Specialist and Valentine Ntui, Plant Biotechnologist at IITA-Nairobi in collaboration with University of California, Davis, USA.

The team found that, when exposed to drought stress, 75% of the edited plants did not show any symptoms of banana streak virus compared to non-edited plants, which confirmed that viral DNA was deactivated.

"This strategy can be applied to improve breeding lines, which can then be used to develop plantain hybrids with no risk of activation of functional virus. The strategy can also enable global dissemination of the resulting hybrids with improved B genome," says Leena Tripathi.

The authors conclude that this strategy could be used to strengthen banana and plantain crops and to develop new hybrids with improved B genome.

"Gene-edited products, unlike genetically modified ones, have their genes simply edited such as deletions and they do not have any foreign DNA introduced. They are therefore not regulated in several countries. The gene-edited varieties can be developed and released much more quickly and less costly in comparison to the genetic engineered varieties," adds Tripathi.



Plantain Gonja Manjaya.

Transforming Abuja Station



Aerial view of the station.

The IITA-Abuja Station continues to be transformed with the addition of new structures as recently outlined by the Head of Abuja Station, [Gbassey Tarawali](#). In his presentation, given during the visit of IITA Board of Trustees Chair [Dr Amos Namango Ngongi](#) on 15 January, Tarawali highlighted the remodeling of old residential houses into ultra-modern office spaces.

Construction of a new office complex was undertaken to meet the needs of the increasing number of scientists and other staff in the station. Related to office accommodation was the construction of a standard, well-furnished guesthouse to serve the lodging needs of visitors and scientists at the Station. This seven-bedroom guesthouse now serves an escalating clientele of outstation staff of IITA and partner institutions.

To improve the security situation of the Station, a perimeter fence has also been constructed on the porous south wing border of the premises. This re-enforcement replaced the old, dilapidated barrier earlier erected by the Federal Capital Territory Administration (FCTA).

The road network within as well as the main access road to the Station also received a facelift. In addition, a diesel dump and a 250kva power generating plant were installed to support smooth business operations in the Station.

From a single screen house and yam barn, support for research and development activities in the Station has been tremendously boosted with the construction of a mega-sized yam barn and three additional screen houses. These new facilities heavily support the yam breeding unit of IITA. In addition, plans have reached an advanced stage for upgrading and modernizing facilities at the old crop processing center to support the biotechnology and genetics resource needs of scientists working on crop improvement in the Station. Presently, the following projects are implementing activities in the Station: ATASP-1, AfricaRice, AgResults, aTTC, N2Africa, AfricaYam, YIFSWA, IYA, Cassava Program, Maize Program, HarvestPlus, and Cowpea Program.

In line with IITA's strategic vision for the Abuja Station as a Center of Excellence for

Agribusiness and Youth Development, a large warehouse to support the seed sector of the North Central agroecological zone was constructed under the former SARD-SC Project. The approximately 271.16 m² seed warehouse will serve the purpose of housing improved seed and planting materials.

While paying attention to the revamping of infrastructure in the Station, the welfare and wellbeing of staff was also given adequate consideration by converting a section of the driver's lodge into a crèche and the employment of an attendant to care for the increasing number of infants of staff in the Station. In addition, an ultra-modern canteen has just been completed with the capacity to serve over 200 members of staff. At present, 153 staff are working in the Station.

While tremendous progress has been made in the development of infrastructure in the Station, key challenges still exist including the completion of perimeter fencing to support the Station's security architecture and the installation of underground tanks for the storage of petrol.



Newly constructed staff canteen.



Reconstructed office building.

IITA Forest Unit hosts the first Ibadan Bird Club Meeting in 2019



Members after bird watching at IITA. Photo: B. Oluleye.

The first meeting of the Ibadan Bird Club (IBC) in 2019 was held at [IITA](#) Ibadan on 26 January. The event attracted 36 members including three children known as the IBC Juniors and nine beginners.

In his opening remarks, IBC Coordinator Adewale Awoyemi welcomed members and introduced them to the basics of bird watching, especially the use of binoculars and guidebooks. He informed members that the birding site was chosen because it was preferred by some beautiful bird species that members might have the opportunity of watching. One of these was the Common Moorhen *Gallinula chloropus*, a beautiful waterbird, which members keenly watched while foraging in a mixed flock comprising the White-faced Whistling Duck *Dendrocygna viduata* and African Jacana *Actophilornis africana*.

Awoyemi explained that waterbirds help to connect different ecosystems. He also said that by foraging on seeds of aquatic plants in an area and defecating at roost sites in other areas, waterbirds are important agents of seed dispersal.

Expressing her pleasure for nature, [Hilde Koper-Limbourg](#), IITA Deputy Director General, Corporate Services, said, "Although the [Forest Center](#) is under the Corporate Services Directorate, I attended this meeting because I love birds. However, I want to use this opportunity to thank all members for their dedication and support for biodiversity conservation." She further emphasized that she would continue to promote biodiversity

conservation, especially the work of the Forest Center at the management level.

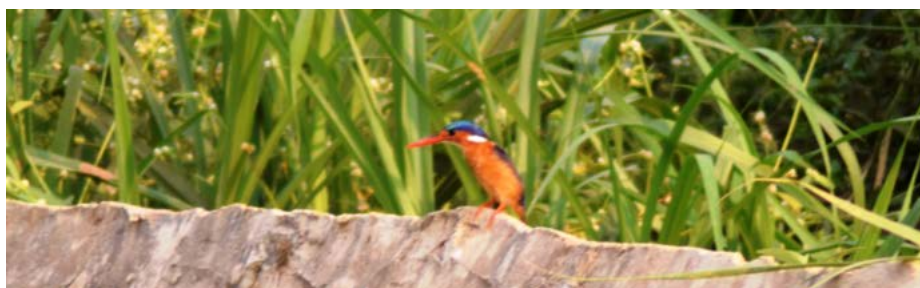
An interactive session was held during the walk, when members highlighted why they attend IBC meetings. For some members, the love of nature and the birds' colorful feathers and melodious songs were the primary reasons for attending, whereas others felt it was a means of energizing the body and soul. From the perspective of members who are teachers, the IBC was a form of "training the trainers," affording them the opportunity of acquiring useful skills which can be passed on to their students. Anastasius Farinola, a member of the IBC club, suggested that a short

note on a bird species with its photograph should be reviewed and published on the [IBC Facebook Group Page](#) every week, to enhance their identification skills. An excited beginner, Ngozi Egwu, volunteered to start the write-up by focusing on the Malachite Kingfisher *Alcedo cristata*, which members regarded as the most beautiful bird sighted during the walk.

Interestingly, 197 birds, distributed across 31 species and 24 families were recorded during the walk. In his closing remarks, long-standing member, Funmilade Olumide, thanked members for attending the meeting and asked them to invite their friends and colleagues to the next meeting slated for 23 February.



A flock of Red-eyed Dove, Vieillot's Black Weaver and Bronze drinking and bathing in a constructed waterway at IITA. Photo: B. Oluleye.



Malachite Kingfisher *Alcedo cristata*, as it scans for prey and predator during the IBC meeting. Photo: B. Oluleye.

IITA-Onne commences livelihood training of Ogoni women and youth



IITA, SDN, HYPREP officials and the training participants.

The IITA-Onne station, Rivers State, in partnership with [Hydrocarbon Pollution Remediation Project](#) (HYPREP) and [Stakeholders Democracy Network](#) (SDN) on 21 January flagged off the first batch of sustainable livelihood training for 17 youth in the fabrication of agroprocessing machines. The event, which took place at IITA-Onne, was attended by HYPREP and SDN officials including the HYPREP Project Coordinator, Marvin Dekil and representatives of SDN, Alexandra Sewell and Jesse Manufor.

The Honorable Minister of Environment, Hassan Zarma, represented by the HYPREP Coordinator, who declared the training open, expressed his satisfaction at the quality of training the Ogoni youth and women were receiving and said he is confident that IITA will do a good job. Meanwhile, the training participants, who arrived a week earlier, were exposed to theoretical aspects such as the role of mechanization in agriculture, food processing and safety, entrepreneurship and record keeping, as well as precision measurement, mechanical efficiencies, safety and user friendliness, and coaching on how to work as a team.

Makil explained that HYPREP is a government body responsible for implementing the clean-up of contaminated areas in Ogoniland, with the core mandate of providing sustainable

alternative livelihoods. He noted that this is the first batch of training participants to benefit from the livelihood training made possible under President Muhammadu Buhari's administration thus urging them to exploit all available opportunities.

Speaking to the participants, he said: "The skills you are to acquire within the next few months are in high demand and lucrative as well. I therefore urge you to give this training your utmost so you can benefit from it and justify the resources committed to it.

"The provision of livelihood is key in the clean-up process as it is meant to achieve one of the deliverables of providing alternative livelihoods for people who have lost their sources of income to oil pollution. The program is designed to provide training to empower the participants to be economically active."

He noted that the program looks beyond the individual and targets restoration of economic activities in the impacted communities by creating employment and income generation opportunities through the establishment of micro businesses. He also mentioned that the training of the first batch of 1,200 women and youth drawn from impacted oil pollution communities will commence soon."

Speaking at the ceremony, Sewell commended IITA for strengthening the livelihood options

and for offering to train the participants on state-of-the-art technologies. He encouraged the participants to stick to the training and learn modern methods that will add value to agricultural products as this will have a ripple effect on the secondary economy. He further said that at the end of the training, beneficiaries would have acquired welding skills and expertise on how to fabricate more processing machines, which is another potential economic opportunity.

Head of IITA-Onne Station [Richardson Okechukwu](#) reiterated the core mandates of IITA, adding that the Institute is in the business of providing alternative sustainable livelihoods to resource-poor farmers as it has lifted millions from poverty. He stated that the key features will be to teach the Ogoni youth and women how to produce machines (attrition mill, sieving machine or sifter, cabinet dryer, peeling machine, press, graters, roaster) and inculcate the agribusiness mindset in them.

Speaking on her expectations for the training, Lucky Sarah said she was elated to be one of the participants, stating that the training gives her hope for a better tomorrow. She said, "If it were food, I would say that the training is delicious," adding that she expects to learn skills that she would, in turn, be able use to train others.



HYPREP Project Coordinator shaking hands with the participants.



Okechukwu (in red cap) showing the guests the various processing machines.