

A JR Biotek Foundation Report

Building Nigeria's Capacity for Climate-Resilient Agriculture through Molecular Biotechnology

Scientific Training to Farmer-Informed Innovation

Project Report | 2025–2026

Delivered in collaboration with the University of Cambridge and Michael Okpara University of Agriculture, Umudike (MOUUAU)

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About this Report

This report documents the development, delivery and emerging outcomes of ***Building Nigeria's Capacity for Climate-Resilient Agriculture through Molecular Biotechnology***, an integrated scientific capacity-building and agricultural resilience initiative implemented during 2025–2026.

The project was delivered through collaboration between the University of Cambridge and Michael Okpara University of Agriculture, Umudike (MOUUAU), with JR Biotek Foundation serving as the core programme development and delivery partner. It was supported by the Mastercard Foundation and University of Cambridge Climate Resilience and Sustainability Research Fund.

The report draws on project implementation records, training reports, participant feedback and evaluation, farmer engagement findings and stakeholder convening reports generated during programme delivery.

It is intended as an institutional programme and impact report rather than an academic research publication. Unless otherwise stated, the analysis, interpretation and forward-looking programme reflections contained in this report are those of JR Biotek Foundation and should not be interpreted as representing the views of the project's funders or collaborating institutions.

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Building scientific capacity for climate resilience: early-career Nigerian scientists undertake hands-on molecular biotechnology training at Michael Okpara University of Agriculture, Umudike, as part of an integrated programme connecting laboratory science with farmer priorities and agricultural resilience. Photo: JR Biotek Foundation

Introduction: From knowledge to application

Nigeria has no shortage of talented agricultural scientists. What remains far less evenly distributed is access to the practical scientific training, research infrastructure, interdisciplinary networks and opportunities required to translate that talent into solutions for agriculture.

Climate change makes that challenge increasingly urgent. Changing rainfall patterns, drought, flooding, heat, pests and diseases are altering the conditions under which farmers produce food. At the same time, advances in molecular biology, genomics, bioinformatics and plant breeding are creating new opportunities to understand crop responses to environmental stress and strengthen agricultural resilience.

But access to sophisticated science alone is not enough. For research to matter, scientists must also be able to connect what happens in the laboratory with the agricultural challenges experienced on the ground. This principle shaped ***Building Nigeria's Capacity for Climate-Resilient Agriculture through Molecular Biotechnology***.

Rather than treating scientific training as an isolated activity, the project connected **virtual scientific learning, intensive hands-on laboratory training, farmer engagement and wider dialogue around climate resilience, indigenous crops and research translation**.

Across the programme, more than 2,300 applications and registrations were received across project activities (online and in-person activities). Scientists accessed virtual and practical training; farmers brought their knowledge and climate experiences into the conversation; and researchers, institutions and agricultural stakeholders considered how stronger connections between science and practice could contribute to agricultural resilience.

The programme therefore created an opportunity to ask a larger question:

What happens when scientific capacity is deliberately connected to the agricultural challenges experienced on the ground?

1. Executive summary

Building Nigeria's Capacity for Climate-Resilient Agriculture through Molecular Biotechnology was designed to strengthen scientific capacity while improving connections between molecular research, climate-resilient agriculture and locally relevant agricultural challenges. The project brought together four complementary dimensions: broad-access virtual scientific learning, intensive hands-on molecular biology training, farmer–scientist engagement, and wider research and stakeholder dialogue.

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The programme generated exceptional interest, with more than 2,300 applications and registrations across project activities. The three-day virtual programme introduced participants to areas including molecular biology, genomics, molecular breeding, diagnostics, bioinformatics, statistics and research translation. Evaluation feedback identified particularly strong interest in R and statistical analysis, molecular breeding, bioinformatics, molecular diagnostics and portable genomics, while participants repeatedly requested more extensive practical training.

This broad-access component was followed by intensive laboratory training at MOUAU. Thirty early-career scientists were competitively selected from more than **1,600 applicants**. Researchers worked directly with DNA extraction, quantification, gel electrophoresis, PCR and molecular data interpretation while strengthening laboratory practice, research thinking and peer collaboration.

Importantly, the programme extended beyond the laboratory. **Fifty farmers** from communities in Abia State participated in structured farmer–scientist engagement, sharing their experiences of changing rainfall, drought, flooding, pests, diseases, declining productivity and other pressures affecting agricultural production. They also identified indigenous crops for which they wanted greater research and extension attention.

A multidisciplinary health outreach delivered alongside the farmer engagement provided health checks and consultations to **96 farmers, extension workers and other attendees**, raising further questions about the relationship between farmer wellbeing and resilient agricultural systems.

The programme subsequently brought together **more than 120 researchers, farmers, academics, government and agricultural stakeholders** to consider climate resilience, research translation, indigenous crops, extension, policy and sustainable research systems.

Taken together, these activities reinforced an important principle that contributes to JR Biotek Foundation’s wider work: **Scientific capacity creates greater value when scientists are connected to the people, problems and systems their research is intended to serve.**

2. Why molecular biotechnology matters for climate-resilient agriculture

Climate resilience is biological as well as social and economic. Plants respond to drought, heat, pathogens, flooding and other environmental stresses through complex processes operating from genes and proteins to cells, tissues and whole plants. Understanding these processes creates opportunities to identify useful traits, improve crops, diagnose emerging threats and develop agricultural technologies better suited to changing environments. Yet advanced molecular techniques remain inaccessible to many early-career scientists working

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within resource-constrained research environments. This creates a fundamental capacity challenge.

If African agricultural systems are to benefit fully from advances in genomics, molecular breeding, diagnostics and bioinformatics, African scientists need opportunities not simply to read about these technologies, but to **understand, use, interrogate and adapt them within their own research contexts**. The project was developed around that need.

3. Expanding access: a virtual scientific classroom

The programme began with a three-day **Virtual Integrated Molecular Biotechnology Training for Climate-Resilient Agriculture**, held from 23–25 February 2026. The curriculum moved from molecular foundations towards increasingly applied and analytical areas of modern plant science.

Participants explored molecular biology, plant–pathogen interactions, molecular diagnostics, molecular breeding and genomics, plant microbiomes, biostimulants, bioinformatics, statistics and innovation pathways. This breadth was deliberate.

Climate resilience cannot be understood through one discipline alone. Genetics may reveal useful variation. Molecular biology can help explain biological mechanisms. Diagnostics can identify threats. Breeding can translate genetic information into improved crops. Bioinformatics and statistics allow increasingly complex biological datasets to be analysed and interpreted rigorously. The virtual programme therefore exposed participants to the **interconnected scientific capabilities required for modern agricultural research**.

4. What participants valued

Participant feedback provided useful evidence of where some of the strongest learning needs and interests lie. Evaluation identified particularly strong engagement with Data Analysis and Statistics with R, Molecular Breeding for Climate Adaptation, Bioinformatics, Molecular Virology and Diagnostics, and Portable Genomics.

Participants reported greater confidence in statistical analysis, stronger understanding of genomic selection and QTL analysis, improved familiarity with bioinformatics workflows, deeper understanding of crop diagnostics, and greater appreciation for experimental rigour and reproducibility.

Some participants also reported that the programme was influencing their research interests and future study, including greater interest in molecular breeding and genomics. Equally important was what participants wanted next: **More practice**.

Requests for longer practical sessions, deeper technical modules and hands-on laboratory opportunities reinforced a challenge JR Biotek Foundation has encountered repeatedly

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through its work: scientific information is increasingly accessible online, but meaningful access to **practical laboratory experience** remains much more constrained. That gap shaped the next stage of the programme.

5. From the Screen to the Laboratory

From 23–27 March 2026, the programme moved to Michael Okpara University of Agriculture, Umudike for intensive hands-on molecular biology training. More than **1,600 applications** had been received for just 30 available places, demonstrating the scale of demand for practical scientific training. Participants came from universities and research institutions across Nigeria.

The laboratory programme focused on building competence in core molecular biology workflows, including:

- laboratory safety and good laboratory practice;
- micropipetting;
- DNA extraction;
- DNA quantification;
- agarose gel electrophoresis;
- polymerase chain reaction (PCR);
- sample preparation and handling; and
- interpretation of molecular biology results.

Participants worked in supervised groups and compared different approaches to DNA extraction and tissue preparation. The emphasis was not simply on following a protocol. Participants were encouraged to understand **why methods work, where they can fail, how contamination and experimental error affect results, and how methodological choices influence the reliability of scientific conclusions**.

6. Putting an African crop at the centre of the science

One of the distinctive features of the laboratory programme was the deliberate use of **Bambara groundnut** within the scientific training. Rather than relying only on conventional laboratory model systems, participants applied molecular techniques to a crop directly relevant to African agriculture.

DNA samples were evaluated and selected for amplification of chloroplast genes associated with photosynthesis and energy metabolism, including *atpA*, *rpl12* and *psbA*. This reflected an important principle within JR Biotek Foundation's approach to scientific capacity

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building: **World-class science does not have to be separated from locally relevant research questions.**

Advanced scientific training can simultaneously build technical competence and encourage scientists to ask questions around crops, biological resources and agricultural challenges that matter within African food systems.

7. Beyond techniques: developing researchers

Technical competence was only one objective of the laboratory programme. Participants also presented their own research projects for discussion and critique and worked collaboratively through the **JR Biotek Foundation Research Innovation Challenge**, encouraging them to connect newly acquired techniques with research questions and potential applications. The programme therefore treated participants not simply as recipients of technical instruction, but as researchers capable of generating new questions, collaborations and ideas.

Early evidence of this multiplier effect began emerging after the workshop. The implementation report records new research collaboration between participants from different Nigerian institutions and reports that some participants had begun introducing DNA extraction techniques acquired during the programme to undergraduate students within their own institutions. This is important for JR Biotek Foundation.

The long-term value of scientific capacity building is not limited to what one participant learns during a workshop. It also lies in **what that scientist subsequently teaches, investigates, builds and shares with others.**

8. Listening to farmers

Laboratory science was deliberately placed alongside farmer engagement. On **25 March 2026**, 50 farmers from five communities participated in farmer–scientist engagement and focus group discussions at MOUAU. The engagement explored farmers’ experiences of climate change, crops important within their communities, existing adaptation practices, constraints to production and priorities for future research and support.

Farmers described experiences including unpredictable rainfall, prolonged dry periods, flooding, increased temperatures, pests and diseases, reduced yields and increasing production costs. They were not passive observers of these changes.

Farmers described adaptation practices including early planting, mulching, organic manure, irrigation, seed preservation and locally developed pest-management practices. At the same time, they reported limited formal climate-adaptation training and inconsistent access to extension support. The engagement therefore revealed both **knowledge and constraint.**

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Farmers already possess significant experiential knowledge of changing agricultural conditions. The opportunity is to connect that knowledge more effectively with scientific research, extension, innovation and institutional support.

9. Indigenous crops and research priorities

The farmer discussions highlighted the continued importance of indigenous and locally valued crops. Eight traditional or indigenous crops were documented through the engagement, with farmers identifying four in particular for greater research and development attention: African black beans (Akidi), three-leaf yam (Una), velvet beans (Ukpo) and cocoyam (Ede).

Farmers identified needs including improved planting materials, pest-resistant varieties, irrigation, access to inputs, storage, extension support, financing and stronger market connections. This raises an important question for agricultural research: **Who determines which crops and problems receive scientific attention?**

For JR Biotek Foundation, farmer engagement provides an opportunity to broaden that process. Farmer observations can help reveal questions deserving deeper scientific investigation, while researchers can bring new tools and evidence to challenges farmers have sometimes managed for generations.

This principle would become increasingly important within the development of **AGRIIP – the Agri-Innovation & Impact Platform**.

10. Science, agriculture and farmer health

The farmer engagement also created an opportunity to look beyond crop productivity. A multidisciplinary health team provided medical and wellbeing services during the engagement. Over a five-hour period, **96 farmers, extension workers and other participants** received health checks or consultations involving medical professionals, pharmacy, nutrition and eye health services. The outreach drew attention to a wider question: **Can agricultural resilience be separated from the health and wellbeing of the people who produce food?**

For JR Biotek Foundation, the experience has contributed to growing interest in the relationships between **farmer health, occupational conditions, climate pressures, agricultural livelihoods and resilient food systems**. Food-system resilience ultimately depends on people as well as crops.

11. Connecting research, policy and practice

On **26 March 2026**, the programme expanded again through a **Policy Makers and Stakeholders Summit on Climate Resilience in Nigerian Agriculture** at MOUAU. More than **120 participants** representing research, academia, farming, government, agricultural agencies and other parts of the agricultural ecosystem participated.

Discussions considered climate-responsive agriculture, indigenous crops, extension, research funding, research translation, institutional systems and the persistent distance between scientific knowledge and practical application. One recurring concern was that valuable research can stop at publication.

The discussions therefore reinforced the importance of research that responds to real problems, stronger connections between researchers and end users, improved pathways between research and application, effective extension systems and institutional environments capable of sustaining innovation.

The significance of the summit was not that it produced a single answer. It was that the programme had brought several parts of the same challenge into conversation: **scientific capacity, farmer knowledge, research institutions, agricultural practice and wider systems of implementation.**

12. What the project taught us

The project began with a focus on molecular biotechnology capacity. It ultimately demonstrated something broader. Training scientists matters, but scientific capacity alone cannot transform agricultural systems.

Researchers need meaningful questions. Farmers need solutions that respond to their realities. Institutions need stronger mechanisms for translating research. Young scientists need access to practical tools and mentorship. Innovation needs evidence, and promising ideas need environments in which they can move beyond the laboratory.

For JR Biotek Foundation, this reinforces the value of connecting scientific capacity building with **farmer-informed research and science-backed innovation.** The lesson is not to make every scientist an entrepreneur or every farmer a researcher. It is to build stronger connections between people who hold different parts of the solution.

13. From capacity building to AGRIP

The project also helped strengthen the foundations for JR Biotek Foundation's next phase of work through **AGRIP – the Agri-Innovation & Impact Platform.** AGRIP builds on more than a decade of JR Biotek Foundation's investment in African scientists while asking a

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larger question: **How can scientific capacity be connected more deliberately with farmers, indigenous crops, research, entrepreneurship and institutions to create lasting agricultural impact?**

The Nigeria programme offered practical opportunities to explore those connections. Scientists gained knowledge and laboratory experience. Farmers identified challenges and crop priorities. Researchers and agricultural stakeholders considered barriers between evidence and implementation. Indigenous crops became subjects not simply of preservation, but of scientific and innovation opportunity. These experiences are helping inform the continued development of AGRIP in Nigeria and beyond.

14. The multiplier effect

The immediate outputs of a scientific training programme can be counted: participants trained, laboratory sessions completed and techniques introduced. The longer-term impact is often found in **what participants go on to do**.

One example is **Harun Ali Kellu**, a lecturer in Biotechnology who participated in the 2026 hands-on molecular biotechnology training. Reflecting on his experience, Harun wrote:

“The experience shaped my perspective as a lecturer in Biotechnology. It reinforced the importance of hands-on, research-driven and problem-solving approaches in biotechnology education. I became more motivated to equip my students with practical skills and expose them to emerging technologies that can address real agricultural challenges, particularly those associated with climate change.”

For Harun, the experience extended beyond acquiring new laboratory knowledge. It strengthened his commitment to developing the next generation of biotechnology professionals and influenced how he thinks about practical, research-driven biotechnology education.

His relationship with JR Biotek Foundation has also continued beyond the training. Harun has since joined the JR Biotek Foundation Scientific Capacity Development Team as a volunteer, contributing his own time and expertise to supporting the development of other scientists.

From participant to contributor



“The JR Biotek experience strengthened both my scientific capacity and my commitment to developing the next generation of biotechnology professionals capable of contributing to climate-smart and sustainable agriculture in Nigeria.” –

Harun Ali Kellu (2026 participant & JR Biotek Foundation Volunteer)

Photo: Harun Ali Kellu: 2026 Hands-on Molecular Biotechnology Training Participant Volunteer, JR Biotek Foundation Scientific Capacity Development Team. Photo: JR Biotek Foundation

Training one scientist can reach far beyond one scientist.

Harun’s journey is one example of the wider multiplier effect JR Biotek Foundation seeks to cultivate. A scientist who gains new knowledge may take that knowledge back to students and colleagues. Researchers who meet through a programme may begin collaborating. New skills can generate new research questions, while greater confidence and access to scientific networks can open further opportunities.

In some cases, as Harun’s experience demonstrates, participants themselves become contributors to the development of others.

These are some of the ways capacity begins to multiply. JR Biotek Foundation’s longer-term interest is therefore not simply in how many people participate in its programmes, but in **what they subsequently teach, research, share, build and contribute within their institutions and wider communities.**

15. Looking forward

The experience of 2025–2026 demonstrates significant demand for advanced, practical and Africa-relevant scientific capacity building. It also demonstrates why the next phase cannot be about training alone. JR Biotek Foundation will continue developing opportunities that strengthen African scientific leadership while connecting research more closely with **farmer priorities, indigenous crops, innovation and practical agricultural challenges**.

The objective is not simply to increase access to molecular biotechnology. It is to help create the conditions in which African scientists can use modern science to investigate questions that matter, work alongside the communities their research is intended to serve and contribute to stronger and more resilient African food systems.

16. The future of African agricultural science must be built locally

The most important outcome of this project may not ultimately be a laboratory protocol, workshop or individual research result. It may be the connections the programme began to strengthen. Between molecular science and African crops; scientists and farmers; research questions and agricultural realities; knowledge and application; between those who receive opportunities and those they subsequently support, and between scientific capacity and the wider systems required for that capacity to create impact. Africa's climate challenges are substantial, but so too are its scientific talent, biological diversity, indigenous knowledge and capacity for innovation. The task ahead is to connect them. **That is the work JR Biotek Foundation intends to continue.**

Closing reflection

The project began with a straightforward ambition: **Strengthen scientific capacity for climate-resilient agriculture**. What emerged was a wider picture of what capacity really means: scientists with the knowledge and confidence to use modern tools; practical opportunities to turn theoretical knowledge into laboratory competence; farmers whose experiences help shape the questions being investigated; greater recognition of the scientific and economic possibilities within Africa's indigenous crops; and researchers who take what they learn back to their students, laboratories and institutions.

At its heart is the ability to build relationships through which knowledge can move, from laboratory to field, from farmer experience to research question, and from scientific discovery towards practical impact. Harun's progression from programme participant to JR Biotek Foundation volunteer captures something important about that vision. Capacity becomes

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most powerful when it multiplies. Scientific capacity is therefore not an end point. **It is infrastructure for what becomes possible next.**

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Project Leadership

- Dr Carol Ibe - Cambridge Lead PI; Founder & Executive Director, JR Biotek Foundation
- Professor Olayinka Ibiwumi Nwachukwu - Africa Lead PI, Michael Okpara University of Agriculture, Umudike
- Professor John Carr - Cambridge Co-Lead, University of Cambridge
- Dr George Okoro - Nigeria Co-Lead, Michael Okpara University of Agriculture, Umudike

We also extend our appreciation to the lecturers, laboratory facilitators, research and extension teams, technical staff, health professionals, participating scientists, farmers, agricultural stakeholders, institutional partners and volunteers whose contributions made the programme possible.

The detailed MOUAU implementation record documents the extensive contributions of facilitators, extension specialists, medical professionals, academics, researchers and stakeholders across the laboratory training, farmer engagement, health outreach and stakeholder summit.

Most importantly, we thank the scientists and farmers who brought their knowledge, questions, experience and commitment to the programme.

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Reimagining Africa's Food Future

Through scientific leadership, indigenous crops, innovation and partnership.

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