



INVITED REVIEW

PlantGENE report on panel discussion: advancing plant biotechnology in Africa

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Abstract

This report provides an overview of the content and data collected from the “Successes, Challenges, and Opportunities Plant Transformation Research in Africa” panel discussion. Organized by PlantGENE, this event brought together scientists and stakeholders across the globe to examine the complex challenges and emerging opportunities in plant transformation research in laboratories across Africa. The discussion, rooted in insights from a panel of six leading scientists, highlights critical issues including restrictive regulatory environments, prohibitive costs, and the inconsistent availability of essential research materials. Additionally, the pervasive “brain drain” phenomenon, where skilled researchers leave the continent for better opportunities, exacerbates the difficulties faced by African scientists. Despite these challenges, the report also identifies significant advancements, particularly in the growing recognition of African leadership within universities and national agricultural research systems (NARS). These institutions, supported by highly skilled faculty and motivated graduate students, are producing high-quality research that contributes to global scientific knowledge. The panelists emphasized the necessity of creating an environment that encourages African scientists to remain on the continent and address local challenges through innovative research. Strengthening intra-African networks and fostering collaborations with the global scientific community are proposed as essential strategies to achieve this. This report underscores the critical need for substantial investments from both global and African organizations, working with African governments, to support these efforts. Furthermore, it calls for science-based decision-making and fair regulatory frameworks to align with unique opportunities and risks associated with technological advancements in Africa. This paper details the observations of six panelists and analyzes the results of attendee surveys in order to document these challenges and opportunities while advocating for sustained investment and strategic partnerships to build a thriving bioeconomy across Africa.

Keywords PlantGENE · Plant transformation · Africa · Panel discussion · Challenges · Opportunities

Introduction

The challenges of plant transformation and maintaining a functioning molecular biology laboratory in Africa have been well documented over the years (Martin *et al.* 2018; Coussens 2021; Chukwudi 2022). Researchers face a myriad of obstacles, including restrictive policies and regulations that hinder end-to-end research, the high cost and unreliable acquisition of essential consumables, and the need for expensive equipment. Moreover, a lack of information on funding opportunities, coupled with bias in competitive funding allocations, has exacerbated the difficulties faced

by African scientists (Marincola and Kariuki 2020; Chen *et al.* 2022). Additionally, there is a concerning trend of talented students leaving the continent in search of better opportunities abroad, further depleting the local scientific talent pool (Marincola and Kariuki 2020; Chen *et al.* 2022). As highlighted in the 2021 UIDP workshop, current partnership models are often ineffective for developing countries, underscoring the urgent need for a new, adaptable model for public–private partnerships that can better serve the needs of Africa (UIDP 2021).

Despite these significant challenges, there are also promising developments within the African scientific community. African leadership is increasingly being recognized within universities and national agricultural research system

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(NARS) laboratories across the continent. These institutions are staffed with highly skilled faculty and supported by hard-working graduate students eager to contribute to global scientific knowledge. The quality of publications emerging from these new scientists attests to their potential and the progress being made.

In order to learn more about these developments and challenges, PlantGENE organized a panel discussion titled “Successes, Challenges, and Opportunities: Plant Transformation Research in Africa” with six leading scientists: Leena Tripathi, Ihuoma Okwuonu, Idah Sit-ole-Niang, Henry Wagaba, Steven Runo, and Modeste Kouassi. PlantGENE is an NSF-funded Research Coordination Network focused on advancing plant bioengineering through community engagement. PlantGENE has organized a number of workshops, panel discussions, interactive events, and initiatives for training, collaboration, and workforce development (Malzahn *et al.* 2024). The global PlantGENE community is now over 1000 members at the time of this writing (<https://plantgene.sivb.org/>). In collaboration with Jim Gaffney, USAID, and Christian Rogers, Cambridge Discovery, the PlantGENE Steering Committee organized this event to share the panelists’ expertise and to survey attendees. The collective knowledge gathered from the plant science community provides insight into some of the successes of plant transformation and areas with opportunity for growth.

To build on this momentum, the next critical steps involve creating an environment that encourages African students to remain on the continent and address local challenges through innovative science. The panelists emphasized the need for strengthening networks among African scientists and fostering collaborations with the global scientific community as crucial strategies for achieving this goal. By facilitating knowledge and scientific exchanges, sharing the latest advances in technology and techniques, and promoting continuous improvement, progress can be accelerated. However, this requires substantial investment from both

global and African donor organizations and governments. As highlighted by the panel, African governments play a pivotal role in creating an enabling environment through science-based decision-making, fair policies, and regulations that align with the risks and opportunities of technology development.

Plant transformation research remains a significant challenge for scientists worldwide, with researchers in Africa encountering both unique obstacles and successes. This panel discussion, led by African scientists, provided an opportunity to share personal research experiences. Panelists discussed overcoming regulatory issues, developing protocols, establishing successful research strategies, and addressing region-specific challenges. Attendees contributed their perspectives through small group discussions.

An overview of African countries with existing and developing plant transformation facilities is provided, with the current facilities listed in Table 1, and the developing facilities outlined in Table 2. Figure 1 lists the existing transformation facilities, which are crucial for assisting other African countries in building their own plant transformation capabilities. This list was submitted by the panel discussion attendees.

The panel discussion highlighted the importance of fostering a bioeconomy rooted in local scientific efforts, supported by global partnerships, as a key direction for advancing plant biotechnology in Africa. This paper aims to document the challenges and opportunities that lie ahead in building a vibrant and thriving “bioeconomy” across Africa, emphasizing the need for sustained investment and strategic partnerships to realize this vision.

Discussion panelists Leena Tripathi serves as the Regional Director of the Eastern Africa Hub at the International Institute of Tropical Agriculture (IITA). With over 25 yr of experience in plant biotechnology, she has been at the forefront of research aimed at improving essential crops like banana,

Table 1. List of various organizations in the African region with established plant transformation facility

Organization name	Country	Plant species (Methods established)
National Agri Biotechnology Research Center, Addis Ababa University, Addis Ababa	Ethiopia	Sorghum
EIAR, Holetta	Ethiopia	
International Institute of Tropical Agriculture (IITA)	Kenya	Banana, cassava, yam, enset, tomato
CIP	Kenya	Potato
Kenyatta University, Nairobi	Kenya	Sorghum, maize, rice, cassava, sweet potato
University of South Africa, Pretoria	South Africa	Wheat
National Agricultural Research Laboratories (NARL), Kawanda	Uganda	Banana, tomato, passion fruit, peanut
National Crops Resources Research Institute (NaCRRI), Namulonge	Uganda	Cassava, sweet potato, rice
National Root Crops Research Institute, Umudike	Nigeria	Cassava, potato

Data presented in the table is based on the information provided by workshop attendees

Table 2. List of various organizations in the African region that are currently developing or have interest in developing methods for plant transformation

Organization name	Country	Plant species of interest
Plant Molecular Genetic Laboratory, Department of Biochemistry, University of Douala, Douala	Cameroon	<i>T. cacao</i> , <i>X. sagittifolium</i> , <i>M. esculenta</i>
Central Biotechnology Laboratory	Côte d'Ivoire	Cassava, cocoa, coffee
College of Agriculture, Hawassa University, Hawassa	Ethiopia	Enset, sweet potato, cassava
West Africa Centre for Crop Improvement, University of Ghana, Accra	Ghana	Tomato, bambara, rice, sorghum, cassava, soybean, cowpea, maize, potato, orchids, banana
Council for Scientific and Industrial Research (CSIR)-Crops Research Institute (CRI), Kumasi	Ghana	All roots and tuber crops, <i>Dioscorea</i>
Kwame Nkrumah University of Science & Technology (KNUST), Kumasi	Ghana	Maize, sorghum, millet, kenaf
KALRO Biotechnology Center, Nairobi	Kenya	Maize, cassava
International Institute of Tropical Agriculture (IITA)	Kenya	Maize
International Centre for Genetic Engineering Regional Research Centre (ICGEB RRC) at Egerton University, Nakuru	Kenya	Maize, wheat, taro, and other crops
National Center for Biotechnology and Genetic Resources (NACGRAB), Ibadan	Nigeria	Trees, cash crops
National Horticultural Research Institute (NIHORT), Ibadan	Nigeria	Banana, cassava, tomato
International Institute of Tropical Agriculture, Ibadan	Nigeria	Cassava
University of Ilorin, Ilorin	Nigeria	Not reported
National Root Crops Research Institute (NRCRI), Umudike	Nigeria	Cassava, root and tuber crops
Agricultural Research Council, Pretoria	South Africa	Maize, banana, sweet potato
Laboratoire de Défense des Cultures et Biosécurité, Institut Togolais de Recherche Agronomique (ITRA), Lomé	Togo	Banana, cassava, sweet potato, cocoyam, taro

Data presented in the table is based on the information provided by workshop attendees

cassava, and yam. Her contributions to agriculture have been globally recognized, and she has been elected as a Fellow of the American Association for the Advancement of Science (AAAS) and a Fellow of the African Academy of Sciences (AAS). During the panel discussion, Dr. Tripathi shared both the successes and the specific challenges faced in plant transformation research in Africa, highlighting the need for tailored biotechnological solutions to meet the unique demands of the region.

Ihuoma Okwuonu is a researcher at the National Root Crops Research Institute in Nigeria, where she leads *in vitro* technology research focused on root and tuber crops such as cassava, yam, and ginger. She is a strong advocate for sustainable seed systems and the sharing of knowledge across African scientific communities. Dr. Okwuonu addressed the critical issue of “brain drain,” where talented individuals often leave Africa for better opportunities elsewhere, emphasizing the importance of creating an environment that encourages African scientists to remain on the continent and contribute to local agricultural advancements.

Idah Sit-ole-Niang, a faculty member at the University of Zimbabwe, specializes in biotechnology with research spanning cowpea genetic improvement and the biotechnological potential of bacteriophages. She is a co-founder of the Network for Genetic Improvement of Cowpea for Africa,

which has played a significant role in advancing research in this area. In her panel contribution, Professor Sit-ole-Niang addressed the regulatory and policy-related hurdles that often impede progress in plant transformation research in Africa, sharing strategies for overcoming these obstacles to foster scientific innovation and agricultural development.

Steven Runo, based at Kenyatta University in Kenya, has a background in long-distance RNA trafficking and has pioneered significant projects such as Genetically Engineered Maize for Drought Tolerance (GEMADOT) and Feed the Future Striga-Smart Sorghum for Africa. In 2020, he was awarded the prestigious Royal Society Africa Prize in recognition of his contributions to science. During the panel, Professor Runo discussed the complex interaction between regulation and licensing in transformation technology research and the challenges that researchers face in accessing and disseminating their findings, highlighting the need for more streamlined processes to accelerate agricultural innovation.

Henry Wagaba is a leading plant tissue culture and molecular biologist from the National Agricultural Research Organization (NARO) in Uganda, holding a Ph.D. in plant breeding and biotechnology with a specialization in cisgenic plant promoters. As a senior research officer at the National Crops Resources Research Institute (NaCRRI), he leads the Plant Tissue Culture Facility and contributes to the “Virus

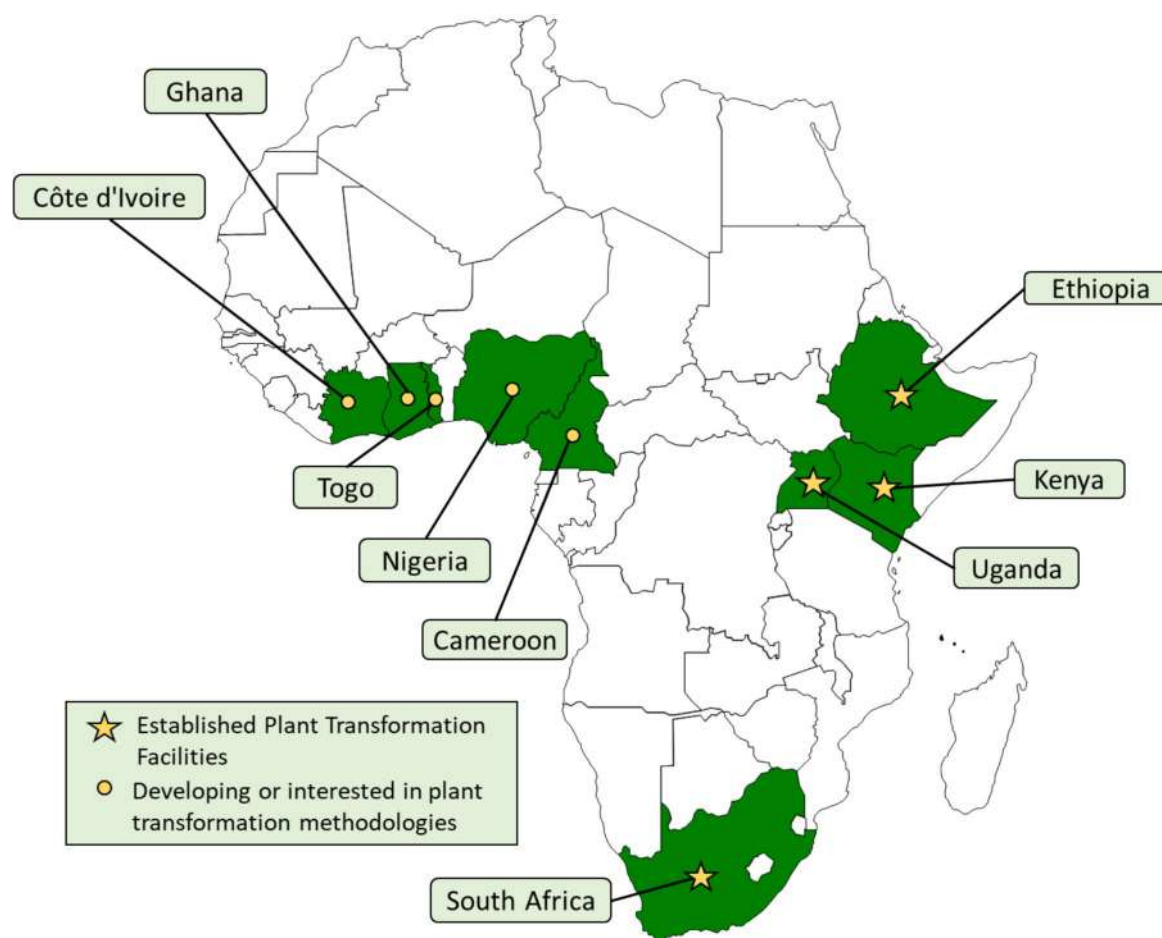


Figure 1. Countries in the African region representing established transformation facilities and universities developing transformation methods for various plant species of interest.

Resistant Cassava for Africa” project. Dr. Wagaba shared his experiences and strategies for building cassava transformation capacity in Uganda, emphasizing the importance of local capacity building collaborative partnerships and infrastructure development in advancing crop improvement initiatives.

Modeste Kouassi is the head of the Plant Tissue Laboratory within the Central and West African Virus Epidemiology (WAVE) program at Université Félix Houphouët-Boigny in Côte d'Ivoire. His extensive expertise in plant tissue culture techniques spans across various woody and non-woody plant species that are difficult to propagate through *in vitro* cuttings, such as rubber and cocoa trees, as well as those that require less complex micro-cutting techniques, such as yams, bananas, and cassava. During panel discussion, Dr. Kouassi shared insights into the challenges faced by plant transformation laboratories in Côte d'Ivoire, particularly the need for improved networking and community-building initiatives to overcome these challenges. He highlighted the

importance of collaboration in driving progress and fostering a supportive research environment.

Panel discussion The panelist's contributions to the discussion revealed a rich tapestry of insights and experiences, each reflecting the diverse challenges and opportunities in plant transformation research across Africa. Leena Tripathi, Steven Runo, and Idah Sit-ole-Niang all emphasized the importance of regulatory frameworks in advancing biotechnology. Tripathi highlighted the successes in regulatory advancements in countries like Kenya and Nigeria, which have led to the commercialization of genetically modified (GM) crops. Runo focused on the need for harmonized regulations across African nations, arguing that uniform, science-based fair policies could streamline the development and commercialization of GM products continent-wide. Sit-ole-Niang underscored the significant policy-related hurdles that impede progress, particularly for crops like cowpea. She shared her experiences with regulatory delays that can

stifle innovation and called for targeted efforts to simplify biosafety processes without compromising safety standards. Progress made within existing frameworks but could be improved by broader regulatory cohesion and more adaptive policies to ensure Africa remains competitive in adopting these technologies (Fig. 2). African attendees were asked to report where they were located and answer several questions about biosafety (Fig. 2). The majority of respondents felt that while transformation was made possible through government policy, biosafety policies negatively impact biotechnology research.

The issue of capacity building emerged as a central theme in the contributions of several panelists, albeit with different emphases to include the diversity of plants of interest in Africa (Fig. 3). Tripathi discussed the establishment of a plant transformation platform at IITA in Kenya, which serves as both a research hub and a training center for the next generation of scientists in Africa. The importance of infrastructure and institutional capacity building was mirrored by Henry Wagaba's account of building cassava transformation capacity in Uganda, where he detailed the practical challenges of setting up and running a tissue culture laboratory.

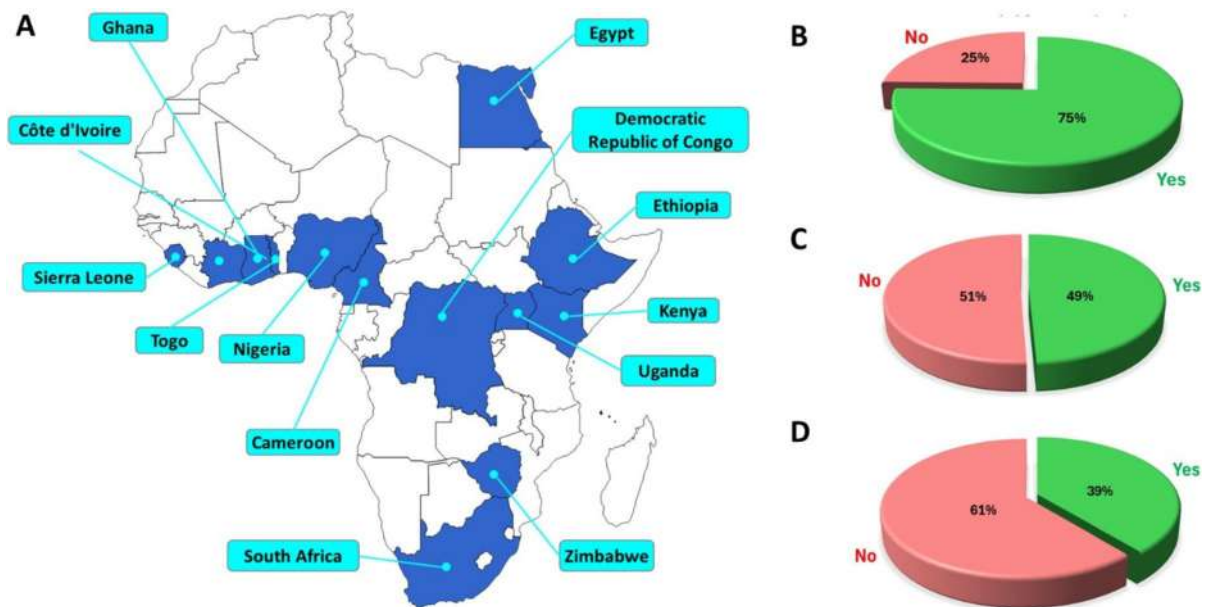


Figure 2. Survey on biosafety law impacts on transformation research in African countries. (A) Map of the respondents' workplaces from African region. (B) Is crop transformation research made possible in

this country by government policy? (C) Is there public acceptance of GM products in this country? (D) Do the biosafety policies negatively impact biotechnology research in this country?.

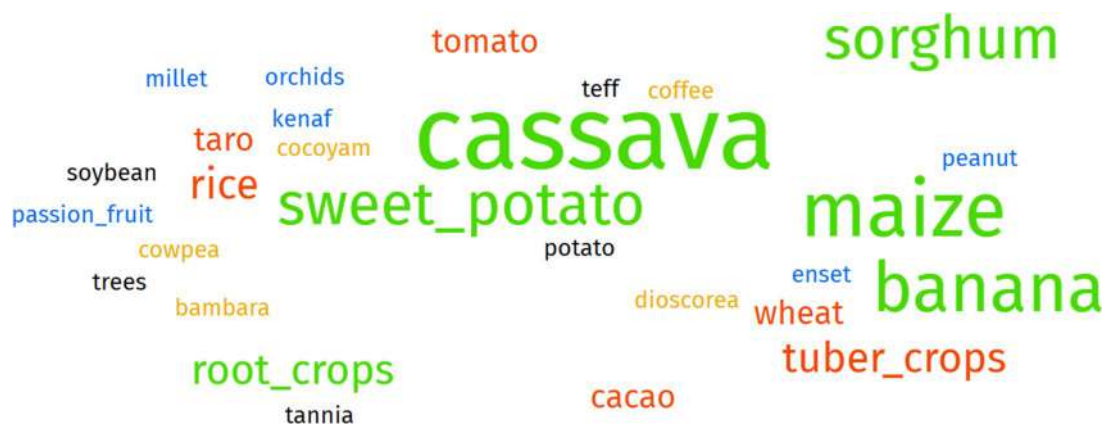


Figure 3. Schematic representation (word cloud) of the plant species researchers have established or are interested in establishing transformation methodologies for improvements of crops that are relevant

to the Africa region. Note: Data based on information provided by workshop attendees. Software reference: <https://www.freewordcloudgenerator.com/generatewordcloud>.

Sit-ole-Niang brought another perspective, highlighting the lack of institutional support for young African scientists in fields like cowpea genetic improvement and emphasizing the need to create mentorship opportunities and training programs tailored to local research priorities. Similarly, Ihuoma Okwuonu addressed the human resource aspect of capacity building, particularly the issue of “brain drain,” and proposed creating collaborative networks within Africa to retain talent and enhance local research capacity. This approach aligned with Tripathi’s more infrastructure-focused strategy, emphasizing the need to foster a supportive community and collaborative environment for scientists. While Tripathi and Wagaba emphasized physical infrastructure and technical skills, Professor Sit-ole-Niang addressed the structural gaps in institutional capacity that often leave promising research efforts underfunded and unsupported. This multifaceted approach to capacity building showcased the diverse needs and solutions required to strengthen Africa’s biotechnology sector (Fig. 4).

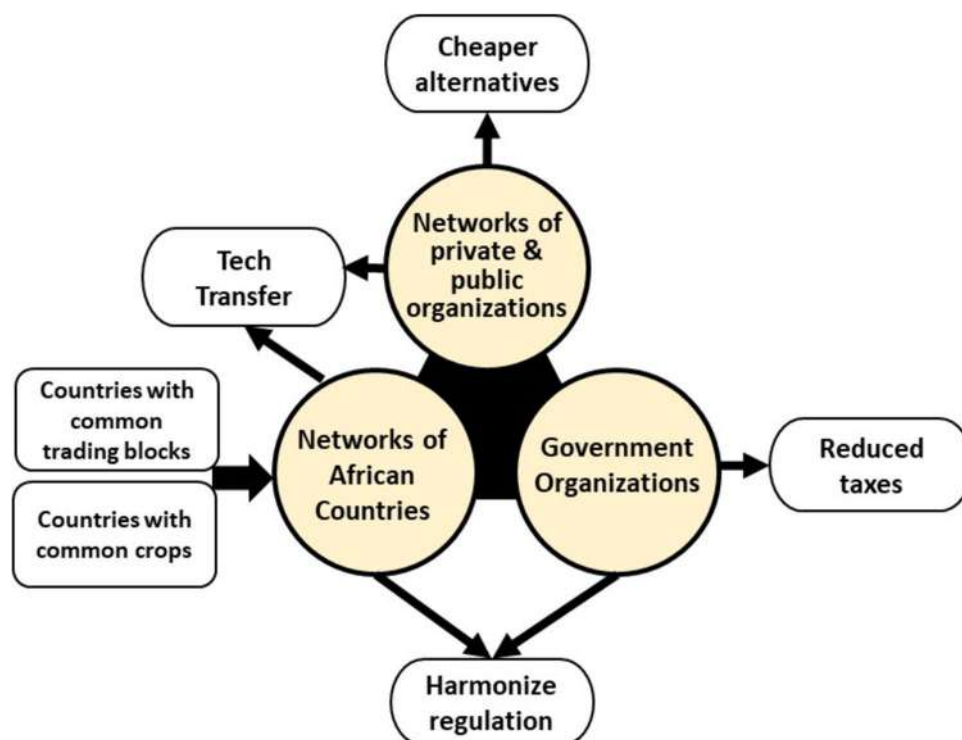
The panel contributions also reflected differing perspectives on the role of collaboration and networking in advancing research. Ihuoma Okwuonu, Modeste Kouassi, and Sit-ole-Niang all advocated for stronger networks among African scientists, though their approaches differed in focus. Okwuonu emphasized the importance of intra-African collaboration to mitigate “brain drain” and build research capacity while Kouassi extended this idea to advocate for more equitable collaborations between Northern and Southern countries. Sit-ole-Niang provided a nuanced

perspective, stressing the importance of fostering regional partnerships that prioritize Africa’s unique agricultural needs. She described her involvement in initiatives like the Network for Genetic Improvement of Cowpea for Africa (<https://www.entm.purdue.edu/NGICA/detail.html>), which has been instrumental in driving innovation and building collaborative frameworks among researchers working on this critical crop. Kouassi’s focus on the social aspect of scientific collaboration, combined with Sit-ole-Niang’s emphasis on aligning partnerships with Africa’s priorities, suggested that overcoming the challenges in African research requires not just regional cooperation but also a more balanced and context-aware global partnership. These differing perspectives on collaboration highlighted the panelists’ shared recognition of the importance of collective effort in advancing plant transformation research, even as they proposed different strategies to achieve this goal.

Progress so far Despite the significant challenges faced by African scientists, there have been noteworthy advancements in the field of biotechnology, demonstrating resilience and ingenuity:

- *Emerging Leadership in Biotechnology:* African universities and NARS are making substantial contributions to global scientific knowledge. Institutions led by highly skilled faculty and supported by motivated graduate students have produced high-quality research, including innovative advancements in plant transformation and gene editing technologies. These achievements highlight

Figure 4. Fostering partnerships to reduce costs and roadblocks to research



the growing leadership of African scientists in the biotechnology sector.

- *Establishment of Research Platforms:* The creation of a plant transformation platform in Kenya is a major milestone. Serving as both a research hub and a training center, it has enabled advancements in crop improvement for staples like cassava and provided training opportunities to build local scientific capacity. This initiative reflects the continent's potential for self-sufficient research infrastructure (Fig. 1).
- *Impactful Public–Private Partnerships:* Programs like the Water Efficient Maize for Africa (WEMA) project have been transformative. WEMA introduced drought-tolerant maize to address the challenges posed by climate change. Supported by organizations, such as the Bill and Melinda Gates Foundation and USAID, these initiatives showcase the potential of collaborative efforts to deliver biotechnology solutions to African farmers.
- *Borlaug Institute Contributions:* In South Africa and Rwanda, the Borlaug Institute has driven progress by enhancing agricultural value chains (Borlaug 2002; Borlaug *et al.* 2014). Initiatives like the Ukulima Farm Research Station in South Africa and the SPREAD project in Rwanda have improved food security, strengthened local economies, and supported the training of future agricultural leaders.

African region: challenges of plant transformation One of the significant challenges discussed was the issue of resource bottlenecks, particularly in the procurement of essential materials and chemicals. In Africa, the procurement process is often much slower compared to wealthier regions, which affects the pace of research and can lead to delays in scientific progress. Another challenge is the crop-specific and cultivar-dependent transformation difficulties, particularly with vegetatively propagated crops, such as banana, cassava, yam, and sweet potato. These crops pose significant challenges due to limited transformation protocols and variety-specific issues that make research more complex. Procurement challenges, such as lengthy government procurement processes and the need to import materials, add another layer of difficulty for researchers in Africa. In some countries like Côte d'Ivoire, regulatory gaps, such as the lack of implementing decrees for national biosecurity laws, make it difficult to carry out plant transformation research.

Isolation and collaboration also emerged as a critical challenge, with research in Africa sometimes occurring in isolation. This isolation can hinder the exchange of ideas and collaboration between scientists, ultimately slowing down progress in transformation research. Attracting high-quality technical staff, postdocs, and scientists to Africa is another significant challenge, as the continent struggles to compete

with wealthier regions in offering the resources and opportunities needed to retain talent. Finally, access to scientific journals and data is limited by paywalls and subscription-based access, restricting African scientists' ability to access the latest research findings, as well as share their research with the global scientific community.

The regulatory frameworks in some African countries can be burdensome, requiring extensive approvals for each research activity (Fig. 2D). This adds to the complexity of conducting research and can be a significant barrier to progress. Additionally, many institutions in Africa suffer from limited infrastructure, with a lack of well-equipped laboratories and research facilities that affect the overall research environment. Access to technologies, including issues related to intellectual property and access to cutting-edge technologies, was also identified as a barrier to research.

The challenge of “brain drain,” where talented scientists leave Africa due to inadequate research conditions and facilities, was highlighted as a major issue. This loss of talent has a detrimental effect on the continent's ability to advance in scientific research. Moreover, regulatory challenges are a significant hurdle, with African scientists often facing obstacles in obtaining necessary approvals, registering laboratories, and dealing with regulatory fees in foreign currency, which is not easily earned locally.

Public acceptance of genetically modified organisms (GMOs) remains a challenge in Africa, with concerns among the public about the introduction of foreign genes into crops (Fig. 2C). This lack of acceptance can hinder the progress of plant transformation research. Inconsistent political will also poses a challenge, as political support for biotechnology can vary, affecting the regulatory environment and the implementation of biotechnology-related agreements.

African region: future opportunities The panel discussion highlights key strategies and potential areas of focus to ensure the continued growth of biotechnology across Africa:

- *Strengthening Intra-African Networks:* Building robust research networks within Africa is essential for knowledge sharing, resource pooling, and collaborative innovation. This will help mitigate “brain drain” by creating opportunities for African scientists to thrive locally.
- *Harmonizing Regulatory Frameworks:* Uniform, science-based regulations across African nations could streamline the approval and commercialization processes for genetically modified crops. This would position Africa as a competitive player in global biotechnology.
- *Expanding Global Collaboration:* Partnerships with international institutions can provide African scientists with access to cutting-edge technologies, funding, and training. These collaborations can accelerate advancements while fostering equitable global research relationships.

- *Investing in Infrastructure and Capacity Building:* Establishing well-equipped laboratories and training centers for advanced technologies, including gene editing and plant transformation, is a priority. These investments will enable African nations to produce world-class research and develop homegrown solutions to agricultural challenges.
- *Encouraging Public–Private Partnerships:* Successful models, such as the WEMA initiative, demonstrate the value of public–private collaborations. Expanding these partnerships can deliver transformative solutions to African agriculture and ensure the sustainability of research outcomes.
- *Promoting Open Access to Scientific Knowledge:* Advocating for open access to scientific journals and data will make research easier to access, and make it easier for the global community to access African research.
- *Developing Value Chains and Economic Models:* Strengthening agricultural value chains, as seen in Rwanda’s SPREAD project, can enhance food security, improve livelihoods, and provide a framework for integrating biotechnological advancements into local economics.

Conclusions

Several African nations currently benefit from the use of GM crops and have established transformation labs at universities and government organizations. Successful partnerships between African nations and African nations in collaboration with UK, EU, and US partners have resulted in advances for crops such as cassava, cowpea, banana, maize, sorghum, and more.

The challenges faced by plant transformation researchers in Africa are multifaceted and deeply rooted in systemic issues, such as restrictive regulations, resource bottlenecks, and the loss of scientific talent due to “brain drain.” Despite these hurdles, there is a growing momentum within the African scientific community, driven by dedicated researchers and emerging leaders who are committed to advancing agricultural biotechnology. The quality of research and the potential for innovation are evident, yet they remain under threat without the necessary support and investment.

To sustain and build on this progress, it is crucial that both local and international stakeholders take concerted action. This includes strengthening intra-African collaborations, harmonizing regulatory frameworks, and addressing the infrastructural and intellectual property challenges that currently impede research. Equally important is the need to create an environment that retains and nurtures local talent, ensuring that African scientists can contribute to solving the continent’s unique agricultural challenges.

Recommendations To address the ongoing challenges in plant transformation research, the panelists underscored the need for researchers to focus on establishing collaborative networks within Africa. These networks would be instrumental in facilitating knowledge sharing, resource pooling, and collaborative efforts on grant applications. By fostering a sense of community and cooperation, researchers can help mitigate the brain drain that often sees trained scientists leave the continent for better opportunities abroad. Additionally, developing a repository of intellectual property (IP) rights for agricultural biotechnology was suggested as a necessary step to help scientists navigate licensing issues and access essential technologies.



Figure 5. Total number of 259 participants joined from 29 different countries including Benin, Burkina Faso, Belgium, Cameroon, Cote d’Ivoire, DRC and Congo Brazzaville, Egypt, Ethiopia, Gabon,

Ghana, Israel, Japan, Kenya, Netherlands, Nigeria, Peru, Rwanda, Sierra Leone, Somalia, South Africa, South Korea, Switzerland, Tanzania, Togo, Uganda, UK, USA, and Zimbabwe.

The panelists recommended several overarching strategies to advance plant transformation research in Africa. Harmonizing regulations for genetically modified products across African countries was a key suggestion, with the aim of creating uniform, science-based policies that would streamline the development and commercialization of biotechnological products. This would help ensure that Africa remains competitive in adopting new technologies. Moreover, the panelists advocated for open-access policies that would require researchers to deposit their publications in accessible repositories, thereby improving access to scientific knowledge and supporting further research advancements.

In terms of solutions, the panelists highlighted the importance of networking and community building, as emphasized by Modeste Kouassi. By promoting more equitable collaborations between Northern and Southern countries, African scientists could benefit from shared equipment, expertise, and scientific progress. This approach would also involve investing in capacity building beyond technical skills, including training procurement officers and fostering relationships with suppliers to enhance research infrastructure. These strategies collectively aim to create a more supportive environment for scientific research in Africa, enabling local scientists to overcome challenges and contribute significantly to global scientific advancements.

Closing remarks Ultimately, the vision of a thriving bioeconomy in Africa hinges on strategic partnerships, substantial investment, and a commitment to science-based policy. By fostering an environment where African scientists are empowered to innovate and collaborate, the continent can not only overcome its current challenges but also position itself as a leader in global agricultural research and biotechnology. Appreciation goes to the 259 attendants from Africa, Asia, Europe, the Middle East, and North America who provided input to the survey results presented in this report (Fig. 5).

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Declarations

Competing interests The authors declare no competing interests.

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