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A Review of Genetically Modified Crops in Nigerian Markets: Deconstructing Myths, Assessing Evidence and Informing Policy (2015–2026)

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Abstract: *Genetically modified (GM) crops have emerged as a focal point in contemporary agricultural discourse, particularly in developing nations where food insecurity, climate vulnerability and regulatory capacity intersect. In Nigeria, public debate surrounding GM foods is characterized by polarized narratives, widespread misinformation and divergent perceptions of risk. This review synthesized empirical market surveillance data, peer-reviewed safety assessments, regulatory documentation and science communication research to distinguish evidence-based facts from prevalent myths regarding GM foods in Nigerian markets. Findings indicate that commercial GM crop cultivation remains strictly limited to Bt cowpea and Bt cotton with market testing revealing negligible unauthorized GM content in staple food commodities. International scientific consensus, supported by decades of compositional, toxicological and epidemiological data, affirmed the safety of approved GM foods for human consumption. However, legitimate concerns persist regarding regulatory enforcement, labelling compliance, seed sovereignty and equitable access. By integrating risk perception theory with biosafety governance frameworks, this paper outlined actionable policy recommendations to strengthen Nigeria's biotechnology landscape. Bridging the gap between scientific consensus and public understanding requires culturally responsive science communication, transparent regulatory monitoring and inclusive stakeholder engagement to ensure that agricultural biotechnology advances food security without compromising public trust or agro-biodiversity.*
Keywords*:* genetically, modified, organisms, Nigeria, biosafety, biotechnology

INTRODUCTION

Genetically modified (GM) crops, also referred to as genetically engineered (GE) crops, are developed through targeted molecular techniques to introduce or enhance agronomic traits such as pest resistance, herbicide tolerance, drought resilience or nutritional fortification (National Academies of Sciences, Engineering and Medicine [NASEM], 2016). Since their commercial introduction in the mid-1990s, GM crops have been cultivated across approximately 190 million hectares in nearly 30 countries, with maize, soybean, cotton and canola representing the dominant commercialized events (International

Service for the Acquisition of Agri-biotech Applications [ISAAA], 2019). While these technologies have demonstrated measurable agronomic and economic benefits, their adoption in Sub-Saharan Africa has been very cautious, shaped by regulatory capacity constraints, public scepticism and export market sensitivities (Adenle *et al.,* 2013; African Union, 2021).

Nigeria faces compounding agricultural challenges such as; a rapidly growing population exceeding 220 million, climate-induced yield variability, post-harvest losses estimated at 30–40%, and persistent micronutrient deficiencies affecting approximately 25% of children under five (Food and Agriculture Organization [FAO], 2022). Pests such as the *Maruca vitrata* pod borer historically reduce cowpea yields by 20–80%, necessitating intensive pesticide use that escalates production costs and environmental exposure (Akinbo *et al.,* 2020). In response, Nigeria approved Bt cowpea and Bt cotton for commercial cultivation following rigorous biosafety assessments. Despite these approvals, public discourse remain heavily influenced by unverified claims regarding health risks, biodiversity loss and corporate control.

This review addressed four central questions:

1. What is the documented extent of GM food presence in Nigerian markets?

2. What does the scientific consensus indicate regarding the safety and environmental impact of approved GM crops?

3. How do prevailing myths and misconceptions compare with empirical evidence?

4. What policy and communication strategies are required to align public understanding with scientific and regulatory realities?

By synthesizing peer-reviewed literature, regulatory reports and market surveillance data up to 2026, this paper contributed to evidence-based biotechnology policy and underscores the necessity of transparent, science-driven public engagement in Nigeria's agricultural transformation.

METHODOLOGY

This narrative review adopted a structured synthesis approach. Literature was sourced from peer-reviewed journals, institutional reports (FAO, WHO, NBMA, AU, IITA) and regulatory documentation published between 2010 and 2026. Search terms included "GMO Nigeria", "biosafety regulation Africa", "GM crop safety consensus", "agricultural biotechnology misinformation" and "Bt cowpea deployment". Inclusion criteria prioritized studies with empirical market data, systematic safety assessments, peer-reviewed meta-analyses and official regulatory publications. Non-peer-reviewed advocacy materials were excluded unless cited to illustrate public discourse dynamics. The synthesis integrated agronomic, toxicological, regulatory and socio-communication dimensions to provide a holistic policy-oriented review.

Nigeria's biosafety regulatory framework

Nigeria's modern biotechnology governance evolved over two decades, beginning with the establishment of the National Biotechnology Development Agency (NABDA) in 2001. Comprehensive statutory oversight was institutionalized through the National Biosafety Management Agency (NBMA) Act of 2015, amended in 2019 to strengthen enforcement, clarify inter-agency coordination and refine risk assessment protocols (Federal Republic of Nigeria, 2015, 2019). The

NBMA operates in alignment with the Cartagena Protocol on Biosafety and *Codex Alimentarius* guidelines, requiring laboratory testing, confined field trials, environmental risk assessment and socio-economic evaluation prior to commercial approval (Oyewole, 2022).

As of 2024, only "Bt" cotton and "Bt" cowpea have received full commercial release, while GM maize and soybean remain under confined or open-field trials (NBMA, 2019; ABU-IAR, 2023). Labelling is mandatory when GM-derived ingredients exceed 1%, though enforcement capacity remained constrained by resource limitations and supply chain complexity (Consumer Protection Council [CPC], 2022). Recent NBMA directives have expanded post-market monitoring requirements and mandated digital traceability for approved GM seed distribution, reflecting ongoing efforts to harmonize with ECOWAS biosafety standards (African Union, 2021; NBMA, 2024).

Border monitoring protocols require biosafety permits for GM-containing shipments. Enforcement actions, such as the 2017 interception and destruction of an unapproved GM maize consignment, demonstrate regulatory vigilance, though capacity gaps persist in high-volume trade corridors (Oyewole, 2018). Processed derivatives (e.g., refined soybean oil, corn syrup) present regulatory gray areas due to the degradation of transgenic DNA during processing, a challenge shared across multiple jurisdictions (Codex Alimentarius Commission, 2009; FAO, 2023).

Empirical evidence of GM presence in Nigerian markets

Contrary to widespread media claims of a "GM food influx," systematic market testing revealed minimal commercial presence of unauthorized GM crops in Nigeria. In 2021, the International Institute of Tropical Agriculture (IITA) analyzed 120 maize and soybean samples from major commercial hubs in Lagos, Kano and Enugu using polymerase chain reaction (PCR) and immunoassay techniques. All samples tested negative for transgenic DNA or proteins, indicating no significant unauthorized cultivation or importation (IITA, 2021). A subsequent 2022 CPC survey of retail and open-market outlets corroborated these findings, detecting GM content only in explicitly imported, permit-cleared processed products (CPC, 2022).

"Bt" cowpea remained the sole approved GM food crop in commercial circulation. Following its 2019 approval, foundation seeds were multiplied through certified public seed systems and distributed to farmers in northern cowpea-producing states. Initial deployment reached approximately 6,000 farmers in 2021, scaling to an estimated 100,000 by 2023 (ABU-IAR, 2023). Despite this growth, "Bt" cowpea accounts for less than 5% of Nigeria's annual 3.5 million metric ton cowpea output and its grain is typically commingled with conventional varieties in supply chains (FAO, 2022). Consequently, most Nigerian consumers have likely not knowingly consumed "Bt" cowpea, underscoring the disparity between public perception and market reality.

The characterization of Nigerian markets as "flooded" with GM foods is empirically inaccurate and reflected the rapid dissemination of unverified claims through digital networks rather than documented agricultural trade patterns (Makinde & Shokunbi, 2020). This gap highlighted the critical role of institutional transparency and science communication in contexts where public trust is fragile.

Scientific consensus on safety and environmental impact

The safety of GM foods for human consumption has been extensively evaluated by independent scientific bodies. The World Health Organization (WHO) stated that GM foods currently available internationally "have passed safety assessments and are not likely to present risks for human health"

(WHO, 2014). The most comprehensive review to date, conducted by NASEM (2016), analyzed over 1,000 studies spanning two decades and concluded that there is "no substantiated evidence of a difference in risks to human health between current commercially available genetically engineered crops and conventionally bred crops" (p. 23). Similarly, the European Commission's synthesis of 25 years and over 500 independent research projects affirmed that GM technologies "are not per se more risky than conventional plant breeding technologies" (European Commission, 2010).

GM crops undergo more rigorous pre-market safety assessment than conventionally bred varieties. Toxicological evaluations for "Bt" proteins (e.g., Cry1Ab in cowpea) demonstrate specificity to lepidopteran gut receptors absent in mammals, with rapid degradation under human digestive conditions (European Food Safety Authority [EFSA], 2013). Allergenicity assessments followed internationally standardized protocols; neither "Bt" proteins nor other transgenes in Nigerian-approved crops exhibit allergenic potential (EFSA, 2013). Compositional analyses confirmed substantial equivalence between "Bt" cowpea and conventional varieties in protein, amino acid, vitamin and mineral profiles, with variations attributable to environmental rather than genetic factors (Codex Alimentarius Commission, 2009; Akinbo *et al.,* 2020).

Long-term consumption data from North and South America, where GM-derived foods have been widely consumed for over 25 years, showed no adverse epidemiological trends attributable to GM ingredients (NASEM, 2016). Livestock feeding studies across multiple generations likewise report no health or performance differences between GM and conventional feed diets (Van Eenennaam & Young, 2014). Environmental assessments indicated that "Bt" crops reduce synthetic pesticide use by 30–50%, lower farmer exposure to hazardous chemicals and demonstrated minimal gene flow risk due to low cross-pollination rates in cowpea (Klümper & Qaim, 2014; Ibrahim *et al.,* 2022). Refuge zone requirements and integrated pest management protocols are enforced to delay pest resistance development (ABU-IAR, 2023).

The frequently cited 2012 Séralini study alleging tumorigenic effects in rats fed GM maize has been thoroughly discredited by EFSA and multiple national food safety agencies due to methodological flaws that included inappropriate rodent strain selection, inadequate sample size and deviation from standardized toxicology protocols. The article was retracted by *Food and Chemical Toxicology* in 2013 and remained outside scientific consensus (Arjó *et al.,* 2013).

Deconstructing myths, misinformation and public perception

Public discourse in Nigeria surrounding GM foods is dominated by recurring narratives that lacks empirical support but resonate emotionally and culturally. These myths persist due to cognitive biases, digital amplification and institutional distrust (Kahan *et al.,* 2012; Omobowale *et al.,* 2013).

Myth 1: GM foods cause cancer, infertility, and chronic illness

No peer-reviewed evidence supported these claims. The narrative often stemmed from misinterpretation of retracted studies, conflating correlation with causation and exploiting legitimate concerns about dietary health. Comprehensive toxicological and epidemiological data consistently refute these assertions (NASEM, 2016; WHO, 2014).

Myth 2: GMOs are engineered for population control in Africa

This conspiracy theory lacks biological plausibility. The genetic architecture of approved GM crops is publicly documented and contained no sequences affecting human reproduction. The narrative reflected historical anxieties regarding external intervention rather than scientific reality (Twardowski & Małyska, 2015).

Myth 3: All chemically treated or unusually large crops are GMOs

This reflects a definitional misunderstanding. Genetic modification refers specifically to laboratory-mediated gene insertion or editing. Conventional breeding, fertilizer use and agrochemical applications are distinct agronomic practices that do not constitute genetic engineering (FAO, 2023).

Myth 4: GMOs inevitably destroy indigenous crop diversity

While monoculture expansion poses valid agro-biodiversity concerns, GM adoption itself does not inherently erase traditional varieties. Seed bank conservation, farmer seed networks, and policy safeguards can coexist with biotechnology deployment. Nigeria's publicly developed "Bt" cowpea, for instance, avoids corporate patent restrictions and supports smallholder retention of conventional seed stocks (Akinbo *et al.,* 2020).

Myth 5: GMOs are banned in Europe due to proven hazards

The EU has approved numerous GM events for import and processing. Cultivation restrictions reflect precautionary regulatory philosophies, political negotiations and market preferences, not scientific determinations of harm (European Commission, 2010; Twardowski & Małyska, 2015).

Misinformation dynamics are amplified by algorithmic content distribution, which prioritizes emotionally charged narratives over neutral scientific communication (Makinde & Shokunbi, 2020). Low baseline science literacy, institutional distrust, and media false equivalence further entrenched polarized perceptions (PACA, 2020; Kahan *et al.,* 2012). Addressing these barriers requires culturally grounded science communication, media literacy initiatives and transparent regulatory reporting.

Legitimate policy concerns and socioeconomic dimensions

While many public fears are empirically unfounded, several substantive policy issues warrant rigorous attention:

Regulatory capacity and enforcement: Sustained funding for laboratory infrastructure, inspector training, and post-market monitoring is essential to maintain biosafety integrity.

Seed sovereignty and equity: Publicly developed GM varieties mitigate corporate dependency, but access disparities for women farmers and marginalized regions require targeted extension programs.

Agro-biodiversity conservation: Integration of GM crops into national seed systems must be accompanied by robust conservation of traditional landraces.

Export market compatibility: Harmonization with ECOWAS and international phytosanitary standards can prevent trade disruptions.

Labeling and traceability: Clear, enforceable labeling protocols empower consumer choice without stigmatizing scientifically validated technologies.

CONCLUSION

The debate surrounding GM foods in Nigeria reflects a complex intersection of scientific evidence, regulatory governance and public perception. Empirical market surveillance confirmed that unauthorized GM crops are not commercially prevalent and international scientific consensus affirmed the safety of approved GM varieties. While sensationalized narratives and digital misinformation continued to shape public discourse, legitimate concerns regarding regulatory enforcement, labelling transparency seed equity and agro-biodiversity conservation requires sustained policy attention. By strengthening biosafety infrastructure, implementing culturally responsive science communication and fostering inclusive stakeholder engagement, Nigeria can harness agricultural biotechnology to enhance food security, climate resilience and rural livelihoods. Bridging the gap between scientific consensus and public understanding is not merely a technical challenge but a foundational requirement for sustainable, evidence-based agricultural policy.

Recommendations

Based on the foregoing analysis, the following evidence-based recommendations are advanced:

1. Strengthen biosafety governance: Expand NBMA laboratory capacity, formalize inter-agency coordination (NBMA, NAFDAC, Ministry of Agriculture), and publish annual post-market monitoring reports.

2. Advance science communication: Deploy multilingual, culturally resonant educational campaigns via radio, television, and community platforms. Establish farmer field schools for hands-on crop comparison and train journalists in evidence-based science reporting.

3. Protect farmer rights and agro-biodiversity: Guarantee seed-saving rights, strengthen community seed banks, and ensure gender-inclusive technology access.

4. Implement labelling and traceability systems: Develop accredited testing infrastructure and digital supply-chain tracking to ensure compliance and consumer transparency.

5. Foster regional and international collaboration: Align with ECOWAS biosafety frameworks, participate in AU biotechnology dialogues and engage experienced regulatory partners for capacity building.

6. Prioritize context-specific research: Invest in climate-resilient, nutritionally enhanced GM varieties suited to Nigerian agro-ecologies. Conduct longitudinal socio-economic and environmental impact assessments.

7. Ensure adaptive and accountable governance: Institute triennial policy reviews, enforce conflict-of-interest safeguards, and align biotechnology strategies with national development goals.

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