A JOURNAL BY SISSA MEDIALAB

ARTICLE

How hunger drives conversations on agricultural technologies: an analysis of the rhetoric of pro-GMO advocates on selected Ghanaian media platforms

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Abstract

Movements opposing genetically modified organisms (GMOs) remain one of the most impactful protest movements in recent times, successfully suppressing the widespread global acceptance of GMOs through strategically crafted anti-GMO rhetoric. Yet, limited research has focused on the arguments used by GMO-promoting advocates. In this media content analysis study, inspired by the Neo-Aristotelian Method of Rhetorical Criticism (NAMRC), we analyze news articles about GMO technologies gathered from the most-read news portals in Ghana. We identify the rhetorical strategies used by GMO-promoting institutions that are reported in media interactions when the legitimacy of these technologies is questioned. We found that pro-GMO rhetoric focuses on themes of problem-solving technology, defensive advocacy, hope for the future, and scientific evidence to persuade publics. In the media coverage we analyzed, pro-GMO advocates defended both the safety of the technology and the legitimacy of scientific research and agricultural innovation. To ensure that advocacy for genetically modified crops is both responsible and credible, advocates of GMO technologies must strike a balance between conveying enthusiasm for these technologies and exercising caution about their limitations.

Keywords

Representations of science and technology; Risk communication; Science and media

Received: 6th July 2024
Accepted: 25th March 2025
Published: 4th June 2025

1 ▪ Introduction

Genetically modified organisms (GMOs) are plants, animals, and other living organisms whose genetic materials have been changed through laboratory procedures to introduce new desired traits that may not be possible through traditional breeding methods [Gyau et al., 2009; Prakash et al., 2011]. Genetic modification, also known as genetic engineering, allows scientists to identify specific genes that govern particular traits in other living organisms, isolate them from their original source, and transfer them directly into the cells of plants, thereby introducing characteristics like pest resistance, disease resistance, herbicide tolerance, improved vitamin A content, among others [Prakash et al., 2011]. This earlier form of agricultural biotechnology is different from Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) genome editing, which is now the so-called revolutionary crop improvement tool gaining attention the world over. Genome/Gene editing (GEd) is an advanced tool that modifies an organism's DNA with greater efficiency and precision than earlier genetically modified technologies, sometimes allowing changes without introducing foreign genes [Evanega et al., 2022; Gakpo et al., 2024; Molla & Yang, 2019; Wang et al., 2022]. CRISPR/Cas9 system is the most powerful GEd tool, and this process uses an RNA-directed DNA endonuclease adapted from the bacterial immune system to locate and cut specific sections of DNA as a way to improve plants and animals [Mao et al., 2019]. However, there are currently no commercially available gene-edited crops in Africa, hence the decision to focus this current study on transgenic genetically modified organisms (GM crops).

More than 70 countries across the world have approved the use of GM crops in their food chains [ISAAA, 2020; Dionglay, 2022; Tome et al., 2024]. In Africa, the acceptance rate is low. Almost 30 years after the first GM crop was approvaed in the USA, GMOs are commercially available in only 9 out of Africa's 54 countries, with trials and approval processes ongoing in 11 others [Busuulwa et al., 2023; Genetic Literacy Project, 2023; Tome et al., 2024]. They have been approved in Ghana, Nigeria, Burkina Faso, South Africa, Eswatini, Malawi, Kenya, Ethiopia, and Sudan [Tome et al., 2024]. Some researchers argue that GMO technology has played a vital role in increasing food production, decreasing the necessity for harmful pesticides, enhancing crop resilience against invasive pests and weeds, and improving farmer income [Brookes, 2022; Waterfield & Zilberman, 2012]. Nevertheless, apprehension regarding patenting and the growing reliance on proprietary seeds, the manipulation of organisms' fundamental genetic composition, and potential future implications of the technology on biodiversity, among other concerns, have dented the image of GMOs globally [Jones et al., 2017; Karalis et al., 2020].

The debate on GMOs in Ghana has been raging since parliament in 2011 passed the Biosafety Act to allow for the application of the technology in the country's agriculture [National Biosafety Authority, n.d.]. The National Biosafety Authority in June 2022 approved one GM crop (cowpeas or black-eyed peas) for local cultivation [National Biosafety Authority, 2022]. That approval, coupled with heightened discussions on the role of technological innovations in improving agriculture following the COVID-19 pandemic, spurred media interest in GMOs between 2021 and 2023 [Gakpo & Baffour-Awuah, 2024]. This study employs rhetorical analysis to analyze the discourse surrounding GMOs on selected Ghanaian media platforms within that period. Specifically, the study analyzed the rhetorics that GMO advocates use in media interactions.

1.1 ▪ *Rhetoric of genetically modified foods*

Over the years, scholarship on food rhetoric has broadened to encompass a diverse range of contexts, including the influence of food practices on identity, the portrayal of food in political culture, the connection between food and national identity, agricultural myths, and the increasing political resistance within food sovereignty movements [Grey, 2014]. Frye and Bruner [2012] identify GM food, food sovereignty, food security, and food insecurity as some of the dominant representations of contemporary food rhetoric. The kind of rhetoric that GMO advocates use when communicating about the technology is an essential subject to study because the way technology gets communicated impacts the potential success of persuasive activities and eventual acceptance or rejection [Bitektine & Haack, 2015; Chong & Druckman, 2007; O'Keefe, 2002].

The rhetoric of GM food has played a crucial role in building a negative public perception of the technology in Europe, the USA, Africa, and other parts of the globe [Clancy & Clancy, 2016; Levidow & Boschert, 2008; Lynas et al., 2022]. Since the beginning of the 21st century, there has been a consumer movement characterized by a cohesive set of narratives opposing GMOs [Gauthier & Kappen, 2017]. Opposition narratives typically revolve around concerns regarding sustainability, the potential adverse effects of GMO products on the environment, and the irreversibility of GMO seed stock once introduced into the environment [Gauthier & Kappen, 2017]. Those who oppose GMOs insist they are not equivalent to conventional and organic foods hence, use words like "unnatural" to describe the genetic engineering process, pointing out that the improvement process happens in laboratories rather than in fields [Peters et al., 2007]. Images illustrating the ramifications of genetic engineering associate the consequences of the technology with diverse environmental disasters and bio-hazardous food [Clancy & Clancy, 2016].

Since the 1990s, anti-GM groups have framed GM crops as a threat to the principles of sustainable and organic farming [Levidow & Boschert, 2008]. Through various channels of advocacy and discourse, these groups have emphasized the perceived risks associated with GMOs and claimed that the technology is incompatible with the values of environmental stewardship and natural harmony. Critics of GM crops from environmental circles argue that the technology perpetuates an unsustainable "treadmill phenomenon" where it addresses immediate needs but ultimately generates a cycle of dependency, necessitating continual solutions for recurring problems [Scott, 2005]. Anti-GM groups have constructed a narrative around GMOs characterized by persistent fearmongering tactics that rely on evocative imagery of "Frankenfood" that often portrays GMOs as unnatural, dangerous, and potentially harmful to human health and the environment [Clancy & Clancy, 2016].

GM critics associate the technology with unsustainable agriculture whilst linking non-GMOs with good agricultural practices that protect local farmers, environments, and food sovereignty [Levidow & Boschert, 2008]. They argue that the widespread adoption of GM crops is linked to monoculture farming, excessive pesticide use, and the loss of biodiversity, which can have detrimental effects on soil health, water quality, and overall ecosystem resilience. Anti-GM activists also claim GMOs mainly serve the interest of multinational corporations that develop and seek to sell GM seeds to smallholder farmers in developing economies like Africa, accusing the companies of taking advantage of these farmers [Vercillo et al., 2015]. They contend that the high cost involved in getting approval for GM crops has created a near monopoly where only a few giant conglomerates are able to get GM seeds

approved and sold worldwide [Fischer et al., 2015; Miller & Conko, 2003]. They say the monopolization of GM technology by private corporations grants them considerable influence over the direction of research, the selection of traits, and the methods of distribution and marketing of GM materials to consumers [Esquivel et al., 2023]. Anti-GM activists argue that reliance on GM crops, often controlled by a handful of multinational corporations, undermines food sovereignty by limiting farmers' choices, increasing dependency on external inputs like seeds and agrochemicals, and reducing agricultural biodiversity.

The low penetration of GM crops in Africa has been linked to the work of anti-GM food activists and the negative rhetoric they use to characterize the technology [Clancy & Clancy, 2016; Lynas et al., 2022]. Anti-GM movements remain one of the most impactful protest movements in recent times, successfully suppressing the widespread acceptance of GM foods [Clancy & Clancy, 2016]. Organized campaigns by GM food opponents that push strategically crafted anti-GMO rhetoric have fostered unfavorable public perceptions of the technology [Lynas et al., 2022]. Through strategic messaging, these groups in Africa and elsewhere have amplified scientific uncertainty surrounding the technology, successfully framed GM foods negatively in the public realm, and downplayed potential benefits while highlighting risks [Galata Bickell, 2019; Lukanda et al., 2023; Osiemo, 2018; Roudik, 2016; Sohi et al., 2023; Yang et al., 2014]. These anti-GM food campaigns have successfully fueled public skepticism and fear in Africa, leading to a widespread perception that GMOs are inherently dangerous.

Some researchers contend media coverage of GMOs in African countries like Uganda, Nigeria, Kenya, and Ghana, inspired mainly by the negative narrative of anti-GM groups, has encouraged the populace to fear GMOs. Lukanda et al. [2023] observe media coverage of GMOs in Uganda has intensified uncertainty about the science and products of genetic modification, often creating a paradox for the public. In Kenya, a study that analyzed media publications in 2022 and 2023 revealed that 40% of the articles promoted negative misinformation about GMOs, with unfounded claims such crops negatively impact human health [Alliance for Science, 2023]. A study by Omeje [2019] revealed that anti-GM activists and government officials were the most quoted sources of media publications on GMOs, with the majority of articles highlighting the perceived risks of GM crops. In Ghana, an analysis of the rhetoric of GMOs in the media revealed civil society often criticized GMOs as being discriminatory and posing risks to both the environment and human health [Kangmennaang et al., 2016].

The success of anti-GM food campaigns partially lies in the fact that they use rhetoric that prioritizes local knowledge and is conveyed through common-sense stories and images to infuse doubt and uncertainty about the notion of objective and universal truths that are traditionally associated with science [Clancy & Clancy, 2016]. Both traditional and social media have been at the heart of ongoing campaigns that have fueled public mistrust of GM foods and negative consumer perceptions of the technology, as they have been key conveyors of anti-GMO rhetoric [Farid et al., 2020; Gustafson & Rice, 2019; McCluskey et al., 2016]. The effectiveness of these opposition narratives in helping build negative public attitudes towards GMOs raises questions about the strategies that government and non-governmental organizations promoting GMOs are using to communicate the technology.

A number of communication initiatives are active across Africa to advocate for GMOs and persuade the public to accept the technology, and some of these organizations have been

active in Ghana. They include the Alliance for Science, a global science communications initiative established in 2014 to "add a stronger voice for science and depolarize the charged debate around agricultural biotechnology and genetically modified organisms" [Shackford, 2014, p. 1]. The institution has evolved since its establishment but it was set up purposely to build the capacity of agricultural sector stakeholders in the developing world to effectively communicate the potential of GMO technology through stories and videos [Alliance for Science, n.d.]. Another such project is the Open Forum on Agricultural Biotechnology (OFAB), based in Nairobi — Kenya. It was established to facilitate 'constructive' GMO conversations among key stakeholders and decision-makers and to improve communication about the technology [African Agricultural Technology Foundation, n.d.]. It currently has chapters in 10 African countries, including Ghana. All the above initiatives train scientists and other actors to communicate effectively about GMOs, particularly in the media. The Biosciences for Farming in Africa (B4FA), which has now folded up, trained journalists to expand media reportage on plant breeding, genetic sciences, and agricultural biotechnologies, including GMOs [Media Development Network Africa, 2012]. As a result of the activities of these pro-GMO communication initiatives in Ghana, there have been heightened media deliberations about the technology on radio, TV, news websites, and newspapers seeking to persuade the public to accept GM foods. This study analyzed the rhetorics that GMO-promoting institutions in Ghana use when they engage the media to advocate for public acceptance of the technology.

2 ▪ Methodology

We sourced data for this study from Myjoyonline.com, Ghanaweb.com, and Graphic.com.gh, which Agyei-Mensah et al. [2022], Ahrefs [2025], Elliott [2018], Media Foundation for West Africa [2017], PenPlusBytes [2023] and Sikanku [2011] identify as some of the most read news portals in Ghana. Graphic.com.gh is the online version of the state-owned Daily Graphic newspaper, the oldest and widest circulating newspaper in Ghana [Agyei-Mensah et al., 2022; Sikanku, 2011], with a readership of about 1.5 million people daily [Elliott, 2018]. According to Ahrefs organic search traffic estimates, Graphic.com.gh was the third most-read news website in the country in December 2024, recording 103,000 visits [Ahrefs, 2025]. Ghanaweb is the most popular news website in Ghana and is particularly famous because it allows readers to create personalized blogs on the website [Sikanku, 2011; Media Foundation for West Africa, 2017]. According to Ahrefs organic search traffic estimates, Ghanaweb.com was Ghana's most-read local news website in December 2024 with traffic of 1.1 million visits [Ahrefs, 2025]. Myjoyonline.com is the news website of Joy FM, the first private radio station in Ghana, and is also the second-most-read news website in Ghana [Agyei-Mensah et al., 2022; Media Foundation for West Africa, 2017; PenPlusBytes, 2023]. Ahrefs organic search traffic estimates, Myjoyonline was Ghana's fourth most-read local news website in December 2024 besides Ghanaweb.com, BBC.com, and Graphic.com.gh, with traffic of 94,000 visits [Ahrefs, 2025]. We conducted extensive searches on these news online platforms to identify articles on GMOs published between January 2021 and December 2023 that specifically quote pro-GMO actors. We used nine keywords to search for all GMO-focused articles published on these news websites: GMO, GMOs, GM foods, GM Crops, Biotech crops, Biotechnology crops, Genetically modified crops, Genetically engineered crops, and transgenics. Ninety-one (91) articles were identified. Out of this figure, 61 of them specifically quoted pro-GMO advocates.

Guided by the methodologies of Braimah et al. [2017], Kangmennaang et al. [2016] and Gauthier and Kappen [2017], we did a content analysis of the quotes of pro-GMO advocates contained in these media articles. Content analysis is a research method that involves systematically classifying and identifying themes or patterns within textual data, enabling subjective interpretation of content [Braimah et al., 2017; Hsieh & Shannon, 2005]. We coded the words of the pro-GMO advocates manually and generated narratives on three levels, as was done by Kangmennaang et al. [2016]. The first step involved identifying the core points that proponents were making about GMOs; the second step shifted focus to recognizing counter-narratives within the main storylines, and the final step involved comparing dominant narratives with counter stories to build a broader narrative [Kangmennaang et al., 2016]. The analysis moved from identifying basic storylines to uncovering the rhetorical power within them and then constructing a broader narrative framework. The Neo-Aristotelian Method of Rhetorical Criticism (NAMRC), also known as the Traditional Method of Rhetorical Criticism, inspired this content analysis. We thus additionally evaluated the context, which is the first step of the NAMRC [Newbold, 2017].

The Chicago School of Criticism, also known as Neo-Aristotelianism, emerged at the University of Chicago between 1930 and 1950, centering on close textual analysis and the examination of literary devices, with a particular emphasis on Aristotelian concepts [Tandon, 2023]. The school reaffirmed the central role of rhetoric in literary criticism and called for a revival of Aristotelian poetics in the study of literature. This theory inspired our content analysis because, as Shen [2011] observes, NAMRC is a rhetorical approach that best sheds light on communication between authors (and, by extension, communicators), and an audience. Its approach of integrating the context of creation and style into rhetorical criticism helps approximate the communicator's norms and better explains their relationship with the audience [Shen, 2013, 2011].

NAMRC involves three steps: evaluating context, applying the five canons, and analyzing the effects [Newbold, 2017]. Only the first step was used in this content analysis. Evaluating the context involves assessing the rhetor thoroughly to understand the political and environmental climate that motivates them, as well as their experiences [Newbold, 2017]. Evaluating the context also requires assessing the audience, what they care about, what persuades them, and their feelings towards the communicator. Also, evaluating the context requires an evaluation of the occasion, including the season and historical contexts, and passing judgment on whether factors like politics, finances, family pressure, environment, delusion, or something else inspired the message. We evaluated the context of the quotes of the pro-GMO advocates to assess the climate that motivated those words, their experiences, the audiences they were targeting, and the factors that were motivating the use of those words. NAMRC helps account for the ability of rhetoric to exert a specific influence on the behavior of an audience within a specific context by focusing on history and judgment [Hendrix, 1968].

3 ▪ Results

In total, 61 articles quoting pro-GMO actors were identified across the three (3) media platforms out of the 91 articles on GMOs published on the three platforms over the three-year duration. 59% of the articles (36 articles) were event-focused stories that sought to report what GMO actors, both pro and anti, had said at workshops, press conferences,

conferences, and other events, while 41% of the articles (25 articles) were stories based on interviews conducted by journalists. The majority, 64% of the articles (39 articles), contained only pro-GMO rhetoric, while 36% (22 articles) contained both pro and anti-GMO rhetoric. Out of the 61 articles, 43% of them (26 articles) were on myjoyonline.com, 36% of them (22 articles) were on Ghanaweb.com, and 21% of them (13 articles) were on Graphic.com.gh. Figure 1 below shows the breakdown of articles analyzed according to media houses.

Various categories of pro-GMO actors were identified in the published media articles. They include scientists, government officials, civil society groups, and farmer groups. Table 1 below shows a breakdown of the institutions that the pro-GMO advocates work with.

One hundred and eighty-three (183) quotes from pro-GMO actors were identified in the 61 articles. Each article contained multiple pro-GMO quotes ranging from two to six. The quotes ranged between 20 and 300 words each. The following themes dominated the rhetoric of pro-GMO actors reported in the media articles analyzed; problem-solving technology, defensive advocacy, hope for the future, scientific evidence, dark present — troubling future, credibility, following the global trend, empathy, and same as traditional breeding.

3.1 ▪ *Problem-solving technology*

Pro-GMO advocates employed a problem-solving technology narrative to pitch GMOs as a necessary and practical response to agricultural challenges. They framed GMOs not as a technology introduced simply to showcase the power of innovation but as a targeted solution

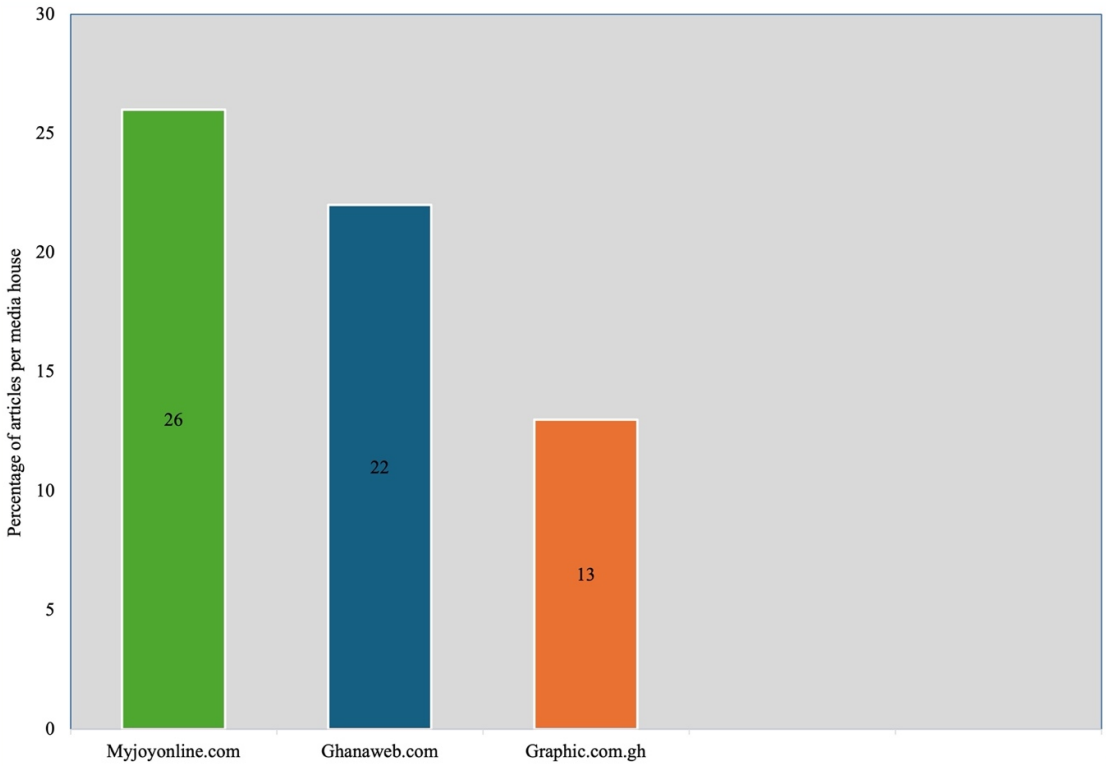

Figure 1. Counts of analyzed articles according to media houses.

Table 1. Affiliate institutions of pro-GMO advocates.

	Scientists	*Government officials*	*Civil Society Groups*	*Farmers*
1	Scientists at Crop Research Institute of Council for Scientific and Industrial Research (CSIR)	Officials of Ministry of Environment, Science, Technology and Innovation	Advocates with Open Forum on Agricultural Biotechnology	Individual farmers
2	Scientists at Savanna Agricultural Research Institute of Council for Scientific and Industrial Research (CSIR)	Officials of National Biosafety Authority	Advocates with Alliance for Science Ghana	
3	Scientists at the Science and Technology Policy Research Institute (STEPRI) of the Council for Scientific and Industrial Research (CSIR)	Officials of Ministry of Food and Agriculture		
4	Scientists at the University of Ghana			
5	Scientists at Ghana Atomic and Energy Commission			

to long-standing issues that have hindered agricultural progress. They emphasized GMOs' potential to address critical challenges in the agricultural sector, such as crop pests, diseases, and food insecurity. They suggested that without the adoption of GMOs, these problems would persist and worsen. One civil society representative who is a science communicator framed this argument using GMO cowpea as follows;

> "Widespread adoption of the PBR (GM) cowpea could make a difference in making more quantities available for the benefit of consumers" (Civil society representative A on graphic.com.gh).

In this statement, the introduction of GMOs was framed as a direct remedy to the issue of limited food supply, specifically in the case of cowpeas, a critical crop. The implication was clear: by adopting GMOs, Ghana could increase crop availability and address the ongoing problem of food scarcity. Another pro-GMO actor who is a plant geneticist reinforced this narrative by framing the adoption of GMOs as a necessary step toward ensuring food security.

> "There is an urgent need for more food to be produced on less land with fewer chemicals… the development of improved varieties (GMOs) of our staple crops with high yields and resistance to the physical and biological stresses is absolutely necessary for a green revolution and food self-sufficiency in Ghana" (Scientist A on myjoyonline.com).

Here, GMOs were portrayed as essential to achieving a revolution in Ghana, enabling the country to produce more food on less land and with fewer environmental impacts. In this way, GMO promoters sought to present GMOs as an indispensable tool for securing food for the future. 61% of all analyzed articles (37 articles) had "problem-solving technology" themes. The next theme is defensive advocacy.

3.2 ▪ *Defensive advocacy*

The GMO promoters spoke as though they felt trapped and depicted themselves as facing intense scrutiny and opposition from critics of genetic engineering and were always fighting back in the media. They framed their advocacy for GMOs as a response to the perceived attacks on agricultural innovation and technological progress, positioning themselves as defenders of scientific advancement. They portrayed themselves as embattled champions of scientific progress amidst a landscape fraught with unrelenting opposition. They were engaged in defensive advocacy because anti-GMO actors had already framed the technology in a negative light. They cast themselves as guardians of rational discourse in the face of what they view as irrational fears surrounding GMOs. A renowned plant geneticist, reflecting on the years of research and regulatory review, emphasized that fears raised by GMO critics lacked credible evidence:

> "It's been 27 years since the first commercial GMOs were released, and I am not aware of a single credible food/feed problem on the safety of GMOs. On the contrary, there is a very strong scientific consensus globally on GMOs just as scientists are on climate change" (Scientist A on myjoyonline.com).

A senior official of the National Biosafety Authority also launched a similar defense of what the official claimed to be unfounded fears about GMOs and said the authority would continue to disregard those, stating;

> "If GMOs are bad, and they can cause cancer and the science is there, the proof is there, we will listen. But if it is based on propaganda to hang it without any basis, that we will not take" (Government official A on myjoyonline.com).

The advocates of GMOs also pointed to what they say is a global consensus on their safety to push back on arguments they can harm the health of humans, insisting rigorous scientific oversight has already validated them. A plant breeder with the Council for Scientific and Industrial Research said;

> "GMO crops, including the cowpea, have been confirmed by thousands of scientific and research organizations in Ghana and worldwide to be as safe as their non-GMO counterparts" (Scientist B on ghanaweb.com).

Experiences from neighboring Nigeria were also shared by a civil society representative to defend the safety of GMOs. The science communicator noted,

> "There is no documented evidence that GMOs have caused any harm to any individual who consumed them. In neighboring Nigeria, farmers have started growing it in their fields. They testify to the crop's positive benefits and also to its safety for both humans and animals and its overall good taste" (Civil society representative A on graphic.com.gh).

What is clear from the above is that the pro-GMO actors were not the ones setting the agenda for GMO conversations in the media. They were usually always pushing back and responding to anti-GM messaging on the technology. 49% of all the articles (30 articles) analyzed had 'defensive advocacy' themes. The next theme is "hope for the future".

3.3 ▪ *Hope for the future*

GMO advocates frequently evoked a sense of hope for the future in their rhetoric, emphasizing what they say is the transformative potential of genetic engineering to address longstanding agricultural problems and improve human well-being for future generations. They painted a vision of a brighter and more sustainable future enabled by advancements in biotechnology, where GMOs played a central role in enhancing crop yields, reducing agricultural inputs, and mitigating environmental degradation. The word "hope" was used many times by the GMO advocates. This theme of hope served to inspire optimism and mobilize public support for GMO research and adoption as a pathway toward a prosperous and resilient agricultural future. One of the central promises of GMOs, according to proponents, is their potential to address pressing nutritional challenges. A social scientist with the Council for Scientific and Industrial Research articulated this vision, stating;

> "Higher yields will help ensure increased availability of the protein-rich crop, improving child nutrition and protein intake and reducing the impacts and frequency of malnutrition. This will go a long way in helping Ghana meet the SDGs 1 and 2 calling for no poverty and zero hunger" (Scientist C on graphic.com.gh).

In this view, pro-GMO advocates painted GMOs not only as a solution to food insecurity but as a critical tool for achieving broader global development goals, especially in combating hunger and malnutrition. For some farmers, the introduction of GMOs was a source of renewed opportunity and hope.

> "I am hoping for a new lease of life in my farming enterprise when I get the GM cowpea seedlings and other new pest and climate-resistant crop varieties" (Farmer A on myjoyonline.com)

The pro-GMO advocates claimed the economic opportunity and the possibility of long-term agricultural sustainability that GMOs bring, offer a sense of "hope" for a better future. 42% of all articles (26 articles) had "hope for the future" themes. The next theme is "scientific evidence".

3.4 ▪ *Scientific evidence*

The GMO promoters extensively cited scientific research, studies, trial results, and peer-reviewed publications to back their assertions about the safety, efficacy, and potential benefits of GMOs to the people of Ghana. They referenced reputable sources such as global scientific organizations, agricultural research institutions, and studies from countries with

established GMO programs to assure there is scientific evidence to support claims genetic engineering technologies are beneficial. They highlighted data demonstrating the positive impact of GMOs on crop yields, pest resistance, and reduced pesticide use. They presented GMOs as a scientifically validated and viable solution to enhance agricultural productivity in Ghana, increase food security, and drive economic growth through improved crop quality. A plant biologist said;

> "To control the pest, farmers typically spray their bean fields with pesticides between eight and 12 times in the 12-week life cycle of the crop. The GM cowpea has proven to be largely resistant to the pest. Farmers can reduce their spraying regime to just twice per season while gaining up to a five-fold increase in yield" (Scientist E on myjoyonline.com).

Supporting this argument, a science communicator with a civil society organization cited broader, global data to emphasize the positive impact of GMOs:

> "On average, genetically engineered crops have cut chemical pesticide use by 37%, increased crop yields by 22%, boosted farmer profits by 38%, and reduced greenhouse gas emissions equivalent to taking 12 million cars off the road" (Civil Society Representative A on myjoyonline.com).

These references to scientific literature served as a key strategy to counteract skepticism and reinforce the argument that GMOs represent a safe and effective agricultural innovation that could significantly benefit Ghana. Through these evidence-based appeals, GMO promoters sought to build a compelling case for the adoption of GMOs, relying on science to persuade their audience. The emphasis on measurable outcomes such as increased yields, reduced pesticide use, and enhanced economic returns was intended to make a logical argument for the technology's potential in Ghana. 31% of all articles (19 articles) had "scientific evidence" themes. The next theme is "dark present, troubling future".

3.5 ▪ *Dark present, troubling future*

The GMO advocates highlighted the possible consequences of food scarcity, hunger, and malnutrition if the technology is not adopted. This was an attempt to appeal to the emotions of the people. They painted a stark picture of the current state of global food insecurity, emphasizing the widespread prevalence of hunger and malnutrition in many parts of the world and the moral imperative to take action to alleviate suffering through the adoption of GMOs. A plant geneticist urged that a shift in thinking was critical to addressing Ghana's pressing hunger and malnutrition challenges through GMOs, noting,

> "We must, therefore, use new thinking in our development agenda else we risk worsening the plight of a significant number of Ghanaians who go to bed hungry, who are malnourished and stunted" (Scientist A on myjoyonline).

A science communicator with a civil society organization said,

> "The hunger burden in Africa is higher than in any other continent in the world and the African situation deserves urgent and special attention. So, we need all the solutions we can lay our hands on, including GMOs" (Civil society representative A on graphic.com.gh).

GMO promoters used the threat of food scarcity, hunger, and malnutrition to emotionally appeal to the public, positioning GMOs as the appropriate tools to alleviate the suffering of vulnerable populations like children, pregnant women, and the elderly. 28% of all articles (17 articles) analyzed had "dark present, troubling future" themes. The next theme is credibility.

3.6 ▪ *Credibility*

The GMO promoters emphasized their authority by highlighting their background and expertise in relevant scientific fields in the media publications analyzed. They positioned themselves as knowledgeable experts who had credibility to discuss the principles and applications of genetic engineering. They sought to not only advocate for GMOs on the basis of scientific evidence but also to reassure the public that their motivations were rooted in a concern for the well-being of the Ghanaian populace. A plant geneticist made a personal appeal, drawing on both professional expertise and parental concern to underscore the importance of trust in their work.

> "As a properly trained scientist and a parent, the safety of these products are of concern. I want to be trusted, and I dream about the health of the next generation and generations yet unborn. I shall not compromise my conscience by speaking so confidently about this subject if I did not understand the issues at stake" (Scientist A on myjoyonline.com).

A social scientist with the Council for Scientific and Industrial Research reiterated this ethical commitment to the safety of the Ghanaian people, asserting that no harm would come from locally developed GMO crops:

> "No Ghanaian scientist will develop any crop that is poison for Ghanaians to eat… Ghanaian plant breeders are also Ghanaians and have families and will therefore not endanger the lives of others" (Scientist C on myjoy-online.com).

Here, the argument was not only based on scientific competence but also shared national identity and familial responsibility, reinforcing the idea that the well-being of the people was a top priority for those involved in genetic modification research. 21% of all articles (13 articles) analyzed had 'credibility' themes. The next theme is "following the global trend".

3.7 ▪ *Following the global trend*

Another prevalent theme in the GMO discourse was the notion that several countries worldwide have accepted the use of GM foods in their food chains, and Ghana should not be an exception. They noted the need for Ghana to follow the worldwide trend of GMO adoption and sought to appeal to Ghanaians to appreciate that the country is not an island but a community within the larger global scheme. A senior official of the National Biosafety Authority remarked;

> "This is the problem of Africa; we tend to wait for others to go far… and by the time we realize it is okay, we become buyers" (Government official A on ghanaweb.com).

Additionally, proponents pointed out there is already a widespread presence of GMO-derived products in Ghana from other parts of the world. A senior official of the Ministry of Environment, Science, Technology and Innovation remarked;

> "Whether we like it or not, such products are already on the Ghanaian market, and we have to begin to consider ways to adopt them entirely. Almost all the imported cornflakes, including Kellogg's and several others, are here in Ghana, and these are typical GMO products" (Government Official B on graphic.com.gh).

Through this framing of GMOs as an inevitable part of global agricultural progress and as products already present in the market, these advocates argued that Ghana could not afford to remain on the sidelines of this technological revolution. They said Ghana needed to follow the rest of the world and adopt GMOs. 16% of all the articles (10 articles) analyzed had "following the global trend" themes. The next theme is "empathy".

3.8 ▪ *Empathy*

The words used in pro-GMO discourse sometimes featured a sense of empathy. The pro-GMO advocates acknowledged the emotional, physical, and economic difficulties faced by farmers in their statements. They for example empathized with farmers who are losing money through pest attacks. The pro-GMO actors tried to make the farmers see that they understood their food production challenges. A civil society representative who is a plant breeder described the dire situation of cowpea farming in the country:

> "Cowpea farming is on its deathbed owing to devastating infestation of maruca pests… The legume pod borer has driven many farmers out of bean cultivation" (Civil society representative C on graphic.com.gh).

Pro-GMO advocates also claimed there is a detrimental effect of anti-GMO activism on global food security and empathized with members of the public who are facing hunger and poverty. A senior official with the National Biosafety Authority stated;

> "Anti-GMO activism has stalled the adoption of GMOs in many countries, contributing to the perpetuation of unsafe pesticide use, hunger, and poverty" (Government official A on ghanaweb.com).

10% of all articles (6 articles) analyzed had empathy themes.

3.9 ▪ *Same as traditional breeding*

GMO promoters drew parallels between modern genetic engineering techniques and traditional agricultural practices. Through the framing of GMOs as a continuation of tradition, they emphasized the natural evolution of agricultural innovation over time. They invoked historical examples of agricultural innovation to illustrate the long history of human ingenuity in enhancing crop yields, improving agricultural productivity, and adapting to changing environmental conditions. They promoted the technology as a natural progression in the quest for agricultural innovation and progress. A plant breeder with the Council for Scientific and Industrial Research said;

> "GM technology has been with us for years and its application in agriculture is just to develop new crop varieties with traits that solve problems of pests, diseases, and drought" (Scientist D on myjoyonline.com)

GMO promoters framed genetic engineering as a natural extension of ancient agricultural practices, emphasizing its role in continuing the long tradition of selectively breeding crops and livestock to improve yields and adapt to environmental changes. 8% of articles (5 articles) had 'same as traditional breeding' themes.

4 ▪ Discussions

The rhetoric employed by pro-GMO advocates in Ghana is complex, multifaceted, and strategically designed to persuade the public, policymakers, and agricultural stakeholders to adopt GMOs. This study found that the top four themes that dominated quotes of pro-GMO actors in the media publications analyzed are: problem-solving technology, defensive advocacy, hope for the future, and scientific evidence. The less dominant themes are dark present — troubling future, credibility, following the global trend, empathy, and same as traditional breeding. The themes of defensive advocacy, following the global trend, same as traditional breeding, dark present — troubling future, credibility, and empathy were more commonly found in myjoyonline.com and ghanaweb.com publications, which are private media houses while problem-solving technology and hope for the future themes were more commonly found in state-owned, graphic.com.gh publications.

The findings of this current study align with that of a study by Kangmennaang et al. [2016] that analyzed the rhetoric of GMO public policy debates in the Ghanaian media. That study found that the discourse is dominated by the rhetoric of entitlement, loss, and endangerment. The rhetoric of entitlement asserts that Ghana and its citizens have a right to benefit from advancements in science and technology, including GMOs. In this current study, the rhetoric of entitlement is particularly evident in the arguments made by scientists and government officials, who emphasize the productivity and necessity of GMOs to improve food security

and agricultural sustainability. This framing conveys the idea that Ghana is entitled to the benefits of GMOs, as they are a proven solution to pressing agricultural challenges like pest infestation, climate change, and food shortages. In the rhetoric of loss, Kangmennaang et al. [2016] report that anti-GM activists claimed growing GM seeds amounted to a society losing natural and pure local seeds, while proponents of GM seeds downplayed this by alluding that since creation, genes have evolved and that there is no pure gene pool. In this current study, GMO promoters positioned modern genetic engineering as a natural extension of ancient agricultural practices, emphasizing that it builds on humanity's long tradition of selectively breeding crops to enhance yields and adapt to changing environmental conditions. They framed GMOs as a logical progression in the ongoing pursuit of agricultural innovation, drawing on historical examples of human ingenuity to illustrate the evolution of farming practices. The rhetoric of endangerment refers to anti-GMO activists framing the technology as a threat to the safety and health of people, in response to which pro-GMO actors framed it as representing hygiene and nutritious food because some GM seeds help manage weeds on farms and offer higher yields compared to local seeds [Kangmennaang et al., 2016]. Similar rhetoric was found in this current study, with pro-GMO advocates framing genetic engineering as a practical, problem-solving technology designed to address long-standing agricultural challenges like crop pests, weeds, diseases, and food insecurity.

Other studies have reported a lot of enthusiasm about the way pro-GMO activists communicate about the technology in Ghana and Africa as a whole, exuding similar excitement that describe it as a problem solver and a tool that offers hope for the future [Busuulwa et al., 2023; Gakpo & Baffour-Awuah, 2024; Lukanda et al., 2023]. Busuulwa et al. [2023] analyzed media coverage of GM crops in six countries across Africa and reported that stakeholders including government officials who engage the media on the technology tout it mainly as one that would ensure economic growth and reduce poverty among the populace. Lukanda et al. [2023] also analyzed media reportage on GMOs in Uganda and reports scientists repeatedly say the technology is a solution to food insecurity, and crop pests and diseases infestation challenges in the country. They also say GMOs increase yields and farmers income and offers hope for more nutritious and drought resilient crops. Gakpo and Baffour-Awuah [2024] found that the Ghanaian media predominantly touted GMOs as a technology that could help the country navigate challenges relating to food insecurity.

We have three main criticisms of the pro-GMO rhetoric on Ghanaian media platforms. First, as Chong and Druckman [2007] point out, the surest way to reverse a society's frame of reference on any issue is to introduce a competing frame of reference. Pro-GMO advocates' introduction of the 'hope for the future' frame appears to be a competing reference to counter the narrative by GM critics that the technology is dangerous. But the 'hope for the future' framing appears to pitch GMOs as a technology for the future and not the present, and this could discourage interest in it. People would have to survive the present in order to be able to create a desirable future. Rhetoric that addresses current challenges would ensure that farmers and agricultural communities see tangible benefits from technological innovations in the present. It will demonstrate the value and relevance of the technology to stakeholders and boost trust and confidence. This trust will form the foundation for widespread adoption and acceptance of the technology, paving the way for future advancements. Prioritizing the resolution of current challenges in agriculture would also ensure that GMO technology remains grounded in the realities faced by farmers and communities today while also laying the foundation for addressing future problems in a proactive manner.

Second, when new technologies are introduced in any society, it triggers a process where some consumers attempt to legitimize or delegitimize the innovation in accordance with their own beliefs and interests [Bitektine & Haack, 2015]. The pro-GMO actors' attempt to pitch global trends as one reason why Ghana must accept GMOs appears to lose sight of that. It pitches GMOs as a foreign technology that is being transferred into Ghana and raises questions about whether it aligns with the beliefs and interests of Ghanaians. This could be perceived as neocolonialism and encourage resistance. If the public sees the technology as a foreign trend that Ghana must follow, its introduction may be perceived as a threat to local cultural identity and autonomy.

Third, the GMO promoters' warning that there will be food scarcity, hunger, and malnutrition if the technology is not adopted as depicted in the 'dark present — troubling future' theme, overly estimates the capacity of GMOs, and that could draw a backlash. According to O'Keefe [2002], persuasion occurs when an individual intentionally and successfully influences another's mental state through communication, within a context where the persuaded individual still retains some degree of freedom of choice. In this context, it appears the audiences are being told there is no alternative solution besides GMOs. While the promise of GMOs to alleviate hunger sounds appealing, the notion of a silver bullet solution oversimplifies the complex issue of food insecurity and fails to address its underlying causes. Pitching a single technology as the sole solution to hunger overlooks the multifaceted nature of the problem and ignores the social, economic, and political factors that contribute to food insecurity. Hunger is a systemic issue with deep-rooted causes such as poverty, inequality, and lack of access to resources. A technological solution alone cannot address these underlying structural issues.

5 ▪ Conclusion

The four dominant themes of problem-solving technology, defensive advocacy, hope for the future and scientific evidence were central to the discourse of pro-GMO advocates, shaping the way they framed genetic modification as a solution to agricultural challenges. Pro-GMO advocates often found themselves defending not just the safety of the technology but also the legitimacy of scientific research and agricultural innovation. Pro-GMO advocates framed genetic modification not as a novelty or an optional tool but as a targeted response to specific, pressing issues such as crop pests, diseases, food insecurity, and environmental degradation. They painted a compelling vision of a brighter, more sustainable future enabled by advancements in genetic engineering. Advocates emphasized the transformative potential of GMOs to address not just agricultural challenges but also the broader societal issues of poverty, hunger, and malnutrition.

We note, however, that pro-GMO actors need to be cautious not to overestimate the capacity of the technology even as they seek to persuade the public to accept it. This is important to ensure the advocacy for genetically modified crops is both responsible and credible. While the promise of GMOs to address key agricultural challenges is undeniably compelling, there is a risk that overhyping the capabilities of GM technology could lead to unrealistic expectations and eventual disillusionment if those expectations are not met. Such disillusionment can erode public trust in both the technology and the institutions promoting it, potentially fueling more opposition to GMOs. Trust is crucial in the GMO debate, and pro-GMO advocates must ensure that they remain grounded in reality and provide a

balanced and evidence-based picture of the benefits and limitations of GM technology. Advocates of GMOs need to strike a balance between enthusiasm for the technology and caution about its limitations.

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How to cite

Gakpo, J. O., Baffour-Awuah, D. and Agyei, D. M. A. (2025). 'How hunger drives conversations on agricultural technologies: an analysis of the rhetoric of pro-GMO advocates on selected Ghanaian media platforms'. *JCOM* 24(03), A04.
https://doi.org/10.22323/1464202506040915000.

ISSN 1824-2049. Published by SISSA Medialab. jcom.sissa.it