"Walking into Slavery with Our Eyes Open"[1] – the Space for Resisting Genetically Modified Crops in Nigeria[2]

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Abstract

This study focuses on genetic modification of cowpea, a food crop grown predominantly by poor men and women in Nigeria and an important source of protein for the poor. The official justification for genetic modification is that it promotes resistance to the Maruca insect, which is said to be capable of destroying up to 80% of a farmer's crop. The genetic engineering of food sources represents an extension of resources for extractive activities from the traditional extractive sectors (oil, gas and solid minerals) to the commodification of life, all in the relentless pursuit of profit. In this article, I take up the question of what has made it possible for genetically modified (GM) crops to be adopted in Nigeria. I begin by exploring the sources of support for such an initiative, their interconnections and their interests in promoting the development of GM crops. This is followed by a feminist analysis of the intellectual politics of this regime and its contested interpretations of science in relation to the development and promotion of GM crops in Nigeria. Finally, I explore the space for resistance to GM crops in the country. Organised resistance has emphasised the risks of inadequate regulation of biotechnology, the damaging environmental consequences, and the threats to food sovereignty. While this is necessary, it is not sufficient. What is missing are feminist perspectives highlighting the extraction of women's labour underpinning the process, as well as the gendered character of access to, and control over, land in the making of livelihoods.

Keywords: Nigeria, genetic modification, cowpea, biotech corporations, intellectual politics

Introduction

The appearance of genetically modified[3] (GM) crops on the agricultural front in Nigeria is relatively recent. In 2016, the National Biosafety Management Agency placed a public notice in one of the national newspapers announcing that Monsanto, now owned by Bayer, was seeking approval for the environmental release and placing on the market of GM cotton (HOMEF and ERA/FoEN, 2016a). This was the first time that the public was notified of such activity. Neighbouring Burkina Faso had introduced Monsanto's pest resistant GM cotton to the country in 2008-2009, following the threat posed to their high-quality home-grown cotton crops by bollworm. The result was a crop that was pest-free and far more abundant. The adoption rate of the new GM seeds increased rapidly and by 2014, they had covered 70% of the cotton area (Sanou *et al.*, 2018). The problem, however, was that the fibre length of the GM crop was shorter and this was due to the Bollgard II variety of GM cotton used (*ibid.*). Overall quality was affected and there was a problem selling the cotton. Although cotton farmers made more money, the new seeds increased their financial risk, according to a study by the French Centre for International Co-operation in Agricultural Research for Development, CIRAD.[4] By December 2016, Burkina Faso had ended the partnership with Monsanto (Bavier, 2017). Yet it is Bollgard II cotton that is now being introduced into Nigeria.

More insidiously, GM technology is now being utilised in Nigeria to develop food crops. The primary focus of this study is GM cowpea, which was approved for commercial release by the National Biosafety Management Agency in January 2019. Cowpea is a crop grown predominantly by poor men and women; in many places it is viewed as a "women's crop". Women generally derive their main source of income from cowpea through processing rather than farming the crop (ACB, 2015). The main argument advanced by policy actors and scientists in support of developing GM cowpea is that it promotes resistance to the maruca insect, which is said to be capable of destroying between 50-80% of a farmer's crop.[5]

Greater policy emphasis on agriculture has taken place in the context of efforts to diversify the Nigerian economy and shift it from its overdependence on oil. Decades of malgovernance, corruption and impunity have entrenched poverty and unemployment in rural and urban areas. Increasing land scarcity and competition for land and water resources among different ethnic and occupational groups in rural communities, which politicians and elites have manipulated to serve their own interests, have resulted in numerous inter-communal conflicts

(Higazi, 2020; Nagarajan, 2020). The pressures on land have been intensified by environmental decline, particularly desertification in the north and erosion in central states, in addition to deforestation (Egwu, 2015). In recent years, armed conflicts between nomadic pastoralists and farmers in rural communities have escalated rapidly. The state's failure to ensure people's security has enabled armed criminal gangs to take over ungoverned rural territories and there have been debilitating levels of cattle rustling (Ibrahim, 2014). Violence in rural areas includes armed robbery, kidnapping for ransom, and village raiding; it has resulted in young men being killed, women raped, and farm produce destroyed (Nagarajan, 2020). As Kyari Mohammed and Chinyere Alimba (2015: 168) point out, "banditry is both a symptom and a cause of rural underdevelopment".

Agricultural policy has proceeded as if insulated from the insecurity surrounding people and agricultural production that results from rural banditry. Nigeria's uptake of GM technology is situated within the government's policy focus on agriculture as a business. The Buhari government's Agriculture Promotion Policy (2016-2020)—the Green Alternative—views agriculture as "key to long-term growth and security" via "government-enabled, private-sector led engagement".[6] Yet farmers using GM crops will ultimately be forced to buy patented GM seeds, resulting in loss of control over conventional seeds for all farmers whilst decreasing women farmers' control over production even further. This can *increase* food insecurity and potentially harm nutrition (Austin-Evelyn, 2011). Nigeria's willingness to adopt risky technology that will result in the loss of autonomy on multiple fronts lies behind the depiction of the current situation as one of "walking into slavery with our eyes open".[7] At the 2011 World Social Forum in Dakar, African women farmers demanded locally grown solutions to farming problems. The Dakar Declaration[8] emphasised the importance of retaining traditional farming practices created by women as well as the need to increase communication amongst rural women farmers to implement ecological solutions as opposed to GM products (*ibid.*).

GM crops are conceptualised here as products of an extractivist economic order. While the oil industry is the archetypal extractive industry, extraction as a mode of accumulation (i.e. extractivism) applies to the removal and depletion of other natural resources too, such as farming, forestry and fishing (Acosta, 2013). Five decades ago, India's "Green Revolution" involved the promotion of a package

of GM seeds, agrochemicals and improved irrigation. Not only did the use of GM seeds reduce genetic diversity among crops and increase their vulnerability to pests, it also damaged the soil, impoverished small farmers and contributed to social conflicts, ultimately resulting in large numbers of farmers being displaced from their land (Shiva, 1991). The depletion of genetic and other resources heralded by the advent of genetic engineering has been referred to as "launch[ing] a new phase in the *industrialisation of life* that has already begun to modify food, trade, land use, livelihoods, cultures and the genetic characteristics of the living world" (ETC Group, 2018a: 4, emphasis added). Women's reproductive work not only subsidises the poor wages of workers in extractivist enterprises but is relied upon to make up for the ensuing degradation of natural resources (WoMIN, 2013; Randriamaro, 2018). Women will be the ones expected to deal with the potentially harmful consequences of risky technologies and bear any additional responsibilities of making ends meet as well as caring for the sick and elderly.

In this article, I take up the question of what has made it possible for GM crops to be adopted in Nigeria. I begin by exploring the sources of support for such an initiative, their interconnections, and their interests in promoting the development of GM crops. This is followed by a feminist analysis of the intellectual politics of this regime and its contested interpretations of science in relation to the development and promotion of GM crops in Nigeria. Finally, I explore the space for resistance to GM crops in the country.

Promoting GM Crops in Nigeria

The main agrochemical and seed firms in Nigeria are Bayer and ChemChina. The acquisitions of Monsanto by Bayer (for $63 billion) and Syngenta by ChemChina (for $43 billion) were announced in 2016. Although Bayer is now Monsanto's sole shareholder and has acquired all of Monsanto's seed products and herbicides, Monsanto's name is dropped from the new corporate entity (DeutscheWelle, 2018). The consolidation of financial and technological power in the new agribusinesses is enormous (Howard, 2018). Biotech corporations do not operate on the African continent in isolation, however; they are enmeshed in a transnational web of institutions, networks and partnerships in industry, philanthropy, government, and science.

The Bill and Melinda Gates Foundation puts vast sums of money into agriculture and public health. Each of these fields has changed considerably as

a result of such interventions. Philip Bereano (2017: section 1, para. 8) states that "The Foundation's support for agricultural development favours industrial high-tech, capitalist market approaches." The Foundation's "clear preference for technological solutions over those that address systemic or social ills" (Freschi and Sheikh, 2011: section 3, para. 2), evident in the public health field, also applies to its approach to agriculture. Such an approach avoids dealing with difficult issues such as social inequality, geopolitical relations, corruption at national levels, and human rights abuses (*ibid.*). Using the market to fulfil ostensibly philanthropic goals means there is an expectation of financial returns or secondary benefits from investments in social programmes. Consequently, philanthropy becomes "another part of the engine of profit and corporate control. The Gates' Foundation's strategy for 'development' actually promotes neoliberal economic policies and corporate globalisation" (Bereano, 2017: section 2, para. 1).

The sheer amount of money donated by the Foundation results in the exertion of an inordinate amount of influence on national governments, researchers, the media, and the broader society. The Foundation is the fifth largest donor to agriculture in developing countries (Curtis, 2016). Between 2009 and 2011, the Foundation spent $478,302,627 on agricultural development in Africa. Regular access to world leaders and financial support of universities, international organisations, NGOs, and media outlets has meant that Bill Gates "has become the single most influential voice in international development". Yet "the Foundation's grants do not support locally defined priorities, do not fit within the holistic approach urged by many development experts, and do not investigate the long-term effectiveness and risks of genetic modification" (Bereano, 2017: section 4, para. 2).

The Bill and Melinda Gates Foundation's funding of the Alliance for a Green Revolution in Africa (AGRA) is a significant mechanism for the exercise of its influence. AGRA claims to be independent yet has two Gates Foundation leaders on its Board.[9] In order to develop Nigeria's huge potential for agricultural development, AGRA targets smallholder farmers while promoting private sector investment, which is predominantly the domain of biotech corporations such as Bayer and others in the GM industry.[10]

The US government actively promotes GM agriculture in African countries through the United States Agency for International Development (USAID). USAID's

advancement of US interests in general are to "promote American prosperity through investments that expand markets for U.S. exports; create a level playing field for U.S. businesses; and support more stable, resilient, and democratic societies."[11] The US government increasingly uses multilateral and bilateral free trade agreements and high-level diplomatic pressure to push countries towards the adoption of corporate-friendly regulations regarding GM crops (GRAIN, 2005). USAID works closely with other donors such as the Rockefeller Foundation and the GM industry. Pro-GM advocacy groups funded by USAID and other donors include the African Agricultural Technology Foundation (AATF), whose headquarters are in Nairobi, Kenya, and the International Institute of Tropical Agriculture (IITA), headquartered in Ibadan, Nigeria (*ibid*.).

In January 2001, an international gathering of cowpea scientists and stakeholders at a meeting in Dakar, Senegal, decided that the only solution to the endemic problem of maruca pod borers affecting cowpea was to use genetic modification. That group subsequently named itself the Network for the Genetic Improvement of Cowpea for Africa (NGICA); its website is hosted by Purdue University. Members come from North America, South America, Europe and Australia as well as Africa. NGICA's activities include raising financial support for research to genetically transform cowpea, forming a partnership with the AATF to increase cowpea productivity and uptake in Africa, and helping the AATF gain access to the gene used in cowpea genetic transformation (NGICA, n.d.).[12]

USAID supported NGICA's partnership with the AATF, which is described as an activity that "will directly benefit women, who form the majority of the cowpea growers. [...] It is estimated that 90% of this benefit will occur in Nigeria because it is the largest cowpea producer in Africa".[13] It should be pointed out, however, that whilst women grow cowpea in Nigeria, it is primarily in the context of subsistence farming; women generally do not grow cowpea as a cash crop. It cannot therefore be assumed that women cowpea growers would be able to afford the cost of GM seeds. Moreover, genetic modification of cowpea does not eliminate the need for chemicals since cowpea is affected by insects other than maruca, such as aphids and thrips, as well as diseases such as leaf spots, leaf rust, bacterial blight and fungal diseases.[14] Even if women had access to the chemicals needed to remove all the above, the costs could be prohibitive. The reference to women being direct beneficiaries of GM cowpea appears to be an instrumentalisation of women to serve the interests of this particular partnership.

Transnational biotech corporations and the proponents of genetically engineered crops would be unable to make much headway without the support of national governments. In 2006, the Open Forum on Agricultural Biotechnology in Africa (OFAB) was established as a partnership between the AATF and host country organisations. The latter are mostly government bodies which act as secretariats for the Forum. According to OFAB, "the raging debate between proponents and opponents of biotechnology where scientific facts are often mixed with social, ethical and political considerations cause (sic) confusion."[15] As a result, policy makers faced with "a rapidly growing population, declining agricultural productivity, climate change and reduced resources available for agricultural research" are "looking for guidance".[16] OFAB, it appears, is here to provide that guidance. The Forum currently operates in seven African countries—Burkina Faso, Ethiopia, Ghana, Kenya, Nigeria, Tanzania, and Uganda—and is funded by the Gates Foundation.[17] In 2009, OFAB Nigeria was launched by the AATF in partnership with the National Biotechnology Development Agency and the Agricultural Research Council of Nigeria.[18]

It is noteworthy that OFAB refers to opponents of GM crops in Africa as "mix[ing]" scientific facts with "social, ethical and political considerations". Yet analysts such as Lodewijk Van Dycke and Geertrui Van Overwalle (2017: 8) point out that "nowadays even agronomists have come to realise that agricultural policy issues do not only involve technical and agronomic issues, but also political, societal and ethical questions." Recognising that policy decision-making is embedded in multi-layered power relations and therefore requires the participation of diverse constituencies, is simply not equivalent to "mixing" facts, scientific or otherwise. Agribusiness thus engages in concerted efforts to marginalise its critics whilst presenting its own partisan stance as value-free and "objective" science.

The fact that extra-scientific relations are implicated in policy directions is clear from the US Government's (2018) Global Food Security Strategy (GFSS) Country Plan for Nigeria. The Plan states that its goal is to "sustainably reduce poverty, hunger and malnutrition" and that, "In supporting this agenda, the GFSS will explicitly facilitate market-led solutions, and emphasise commercially viable participation of private sector actors" (*ibid*., 21). "Direct engagement with the private sector will be critical to the success of the GFSS country plan. [...] Agricultural production will be demand driven, refocusing production-based efforts

within a market based framework that recognizes the market as the driver and requires that investments be aligned with market needs and evaluated against market performance" (*ibid*., 22). The Plan's repeated emphasis on the market and the opening up of food systems to the private sector make it clear that this "sustainable poverty reduction" enterprise is to be embarked upon regardless of the knowledge or consent of local farmers and consumers, whether women or men.

National agricultural research institutions, such as the Institute of Agricultural Research (IAR), Ahmadu Bello University, Zaria, are increasingly attractive to seed companies searching for new markets. A seed company in India called Mahyco recently collaborated with IAR to produce Bt cotton, an insect-resistant GM cotton. The GM varieties are cultivated in India in large quantities and Mahyco wants to be able to sell its products on the Nigerian market. IAR tested the GM lines alongside the conventional variety all over Northern Nigeria. They reported that the staple lint length of the Indian GM cotton was longer than that of local cotton varieties and the Bt cotton produced was more than double the conventional cotton varieties, which usually produce a maximum of two tons per hectare.[19]

Mahyco, it turns out, has a 50:50 joint venture with Bayer which enables the latter to sublicense its Bt cotton seeds to Indian seed companies. After the Modi government's move in 2016 to regulate the selling price of GM cotton seeds and to cut royalty fees by a hefty 74%, Bayer had threatened to shut down its business in India (Karnik and Balachandran, 2016). Nigeria simply offers an alternative market for Bayer to sell its Bt cotton. Two new varieties of Bt cotton were approved for commercial release in July 2018. The Chair of the National Committee on Naming, Registration and Release of Crop Materials stated that "the release and registration of GM cotton is revolutionary to the agricultural development of the country as it would lead to the future adoption of GM technology in Nigeria of *food* crops" (Offiong, 2018, emphasis added).

In January 2019, the Nigerian Biosafety Management Agency approved a permit for IAR to begin commercial release of genetically modified cowpea, bred to resist *Maruca vitrata*—Pod Borer-Resistant Cowpea (PBR Cowpea-event AAT709A) (IITA News, 2019). The development of GM cowpea comes at a time when both the production and yield of conventional cowpea have been increasing in Nigeria in recent years. This raises yet again the question of why GM cowpea should even be developed at this point. The African Centre for Biodiversity (2015) points to the current convergence of interests between the GM biotech industry—in its efforts

to develop regional seed markets through the harmonisation of seed laws and intellectual property rights—and private sector seed companies, given the attraction of larger markets generating correspondingly higher profits. The following section takes up contestations surrounding the conduct and interpretation of science in the development and promotion of GM crops in Nigeria.

The Prevailing Scientific Ethos

One of the challenges faced by activists resisting GM food crops in Nigeria is the widespread trust in "science". There is a generalised assumption that when scientists speak, "the scientist must be stating a fact, must be socially conscious ... We know that this is not true, a lot of scientists are not pro-people and we are not against science but science must be responsible".[20] This position is not one of absolute condemnation of genetic engineering, given that the technology has been used to benefit people by producing insulin, for example. It is instead, a position that insists on the need to be critical: "whatever science and technology makes possible must be judged for its benefit across the entire stream of life. [...] you must evaluate technologies, especially genetic engineering that you want to use in agriculture. And the question would be, *Why?*"[21]

In this section, I highlight the official construction of a rigid and unwarranted binary between "certainty" and "uncertainty" which is utilised in mainstream assessments of risk surrounding GM food crops. The imposition of such a binary relies on a reductionist notion of "scientific objectivity" that serves technological interests marked by an obsession with control over life. Over two decades ago, in 1993, Vandana Shiva (2014: 23) argued that "the ontological and epistemological assumptions of reductionism are based on uniformity", in which all systems were presumed to be made up of the same basic constituents that could be divided and manipulated. The traditional scientific compulsion towards separation and disembodied objectivity has long been critiqued by feminist philosophers of science, highlighting the impossibility of separating either bodies or technology from nature and the denial of complexity that such efforts represent (e.g. Haraway, 1988; Keller, 1995).

Critical biotechnology researchers point out that genetic engineering does not involve the kind of control over genes that biotech corporations would have us believe. "Each gene may control several different traits in a single organism. Even the insertion of a single gene can impact the entire genome of the host

resulting in unintended side effects, all of which may not be recognizable at the same time. It is difficult to predict this type of risk" (Prakash *et al.*, 2011: 2). Moreover, biotech corporations present the act of extraction of genes from one organism and insertion into another as a relatively straightforward process; this too is not the case. "When genetic engineers create GMO or transgenic plants, they have no means of inserting the gene in a particular position. The gene ends up in a random location in the genetic material, and its position is not usually identified [...] There are already several examples of such undesired effects being identified in the US after approval e.g. GM cotton with deformed cotton bolls" (Prakash *et al.*, 2011: 3).

Efforts to grapple with the uncertainty surrounding the development of GM crops have given rise to the Precautionary Principle in biotechnology. This refers to the need to err on the side of caution in adopting genetically modified organisms (GMOs), given their potentially adverse consequences for humans, animals, the ecosystem and biodiversity.[22] Lying on the border between science and governance, the precautionary approach plays an important role in international treaties such as the Cartagena Protocol on Biosafety.[23] The Precautionary Principle is defined as follows: "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically" (CHE, n.d.). Such an approach "acknowledges the complexity and variability of the natural environment and embodies [a] certain humility about scientific procedures and knowledge. It prioritizes the rights of those who stand to be affected by an activity rather than those who stand to benefit from it" (Prakash *et al.*, 2011: 8).

Contrary to the Precautionary Principle is the concept of Substantial Equivalence, which posits that GM products should be assessed for the potential risks they pose by determining whether "a GM food product is as safe as its traditionally bred counterpart" (Mhyr, 2007: 5). Safety of the GM food product involves "rigorous scientific analyses with the purpose of identifying all changes being introduced to the organism" (*ibid.*, 6). While this approach focuses on changes being made *to* the host, it does not adequately consider changes made *by* the genetically manipulated organism. The latter would include assessments of immunological or biochemical effects, or ecological and socio-economic impacts (Millstone *et al.*, 1999, cited in Prakash *et al.*, 2011). GMO proponents argue that

"there does not seem to be any reason to expect different impacts from genetically modified organisms than from traditional agricultural products" (Mhyr, 2007: 6). This begs the question of why there would have been any modification in the first place if no differences in impact were to be expected. By abstracting the *product* of genetic engineering from the *process* of its development as well as the *practices* inherent in the use of such technology in context—which include a harmful package of accompanying herbicides and/or pesticides—proponents of the concept of substantial equivalence erase significant domains of risk.

This is not a neutral debate since certain financial and political interests are served by asserting "no reason to expect different impacts". Bayer and US regulatory agencies have used the concept of substantial equivalence to facilitate the commercialisation of GM food products by effectively categorising GM food as "generally recognized as safe" (van den Hombergh, 2012: 52). This means that the products require "no labelling, no traceability (of where they come from), no corporate liability in case of negative effects and no ongoing collection of data on health effects" (*ibid*.).

The Open Forum on Agricultural Biotechnology in Africa (OFAB), Nigeria chapter denies any uncertainty surrounding GM technology. Located in the National Biotechnology Development Agency, OFAB carries out sensitisation workshops, seminars, exhibitions and travel tours promoting GM crops. One of the brochures used for "sensitisation" asserts that "Genetic modification is literally the essential feature of all life on earth. [...] It is, in fact, a feature of our own, human, genetic makeup. We are all 'GMOs' as is every organism on Earth". GM plant breeding is described as "precision breeding", using "methods that are more precise, predictable and controllable than historical methods long accepted as safe".[24] This blatant manipulation of the concept of "modification" inherent in "GM", constitutes disinformation designed to dull potential resistance to the use of GM technology. In the context of the erosion of higher education in Nigeria and weak public capacity for critical thinking, the sustained repetition of OFAB's "information" about GMOs is likely to make considerable inroads into a state and transnational project of manufacturing consent to the adoption and promotion of genetically engineered crops in agriculture.

Meanwhile, staff at the National Biosafety Management Agency do not have the capacity to extract a genome, or sequence, edit or modify it in any way.[25] The

resources for using the technology are highly restricted; the agency's laboratory is a small Portacabin outside its main building. All the GM materials that form the basis for trials in-country are initially developed in the US, Europe or Australia before being brought to Nigeria. After field trials have been conducted in-country, the varieties are sent to "advanced universities" abroad for toxicity tests.[26] Dr. Casmir, a microbiologist at the University of Abuja, points out that it does not make sense to promote GM food crops in Nigeria in the absence of capacity to use GM technology and manage the process of development from beginning to end, including potential mishaps: "there can be no food security without food safety".[27]

In-country trials of GM materials are generally conducted at national research institutes such as IAR at Ahmadu Bello University, Zaria. The Director's overall perspective on genetic modification is that, "As a research institute, we are doing research... we don't have any law that has prevented [a] research institute from doing work on GMO and that is the only way we can even be convinced whether it is bad or good [...]."[28] Research on GM crops is presented by the Director as inherently neutral and objective, its benign character being underpinned by the existence of a bureaucratic regulatory entity, the National Biosafety Management Agency. As feminist epistemologists have shown for some time, however, science does not operate in a social or political vacuum. Instead, it operates within gendered power relations that shape which questions are worthy of study, whose views count as "knowledge" (e.g. Harding, 1987; Keller, 1995). Feminist ecologists (e.g. Shiva and Moser, 1995) have pointed out that proponents of GM technology have undermined their own claims to "objectivity" by exaggerating the technology's benefits to the exclusion of very real risks.

In 2013, over 300 scientists, physicians, academics and experts signed an open letter declaring that "claims that GM foods are safe for human health based on the experience of North American populations have no scientific basis", given the lack of epidemiological studies of health effects in people consuming GM food (Hilbeck *et al.*, 2015: Discussion, no. 2). The lack of labelling and monitoring make it "scientifically impossible" to carry out such studies in the US. Furthermore, "claims that there is a consensus among scientific and governmental bodies that GM foods are safe, or that they are no more risky than non-GM foods are false" (*ibid.*: Discussion, no. 3). There is also no consensus on the environmental risks of GM crops, including the effects of Bt crops on non-target organisms and the effects of

herbicides used alongside crops genetically modified to tolerate herbicides. Target pests have developed resistance to Bt toxins. "As with GM food safety, disagreement among scientists on the environmental risks of GM crops may be correlated with funding sources." (*ibid.*: Discussion, no. 6). Those scientists who were most likely to have a positive attitude to GM crops tended to be ones with industry funding and/or who were trained in molecular biology; they were of the view that GM crops did not constitute any unique risks. Scientists receiving public funds and working independently of GM crop developer companies as well as those trained in ecology "were more likely to hold a 'moderately negative' attitude to GM crop safety and to emphasize the uncertainty and ignorance involved" (Hilbeck *et al.*, 2015: Discussion, no. 6).

In cowpea, the genetic transformation involved the insertion of a soil bacterium called *Bacillus thuringiensis* (Bt) which confers resistance to maruca in maize crops. Bayer provided the genes and the initial development of a GM form of cowpea was carried out at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Canberra, Australia. The researchers developed cowpea lines with the Bt (Cry1Ab) gene that conferred resistance to maruca pests in the lab. Bayer patented the Bt gene used to transform cowpea and licensed it to the influential African Agricultural Technology Foundation for use in Africa. The AATF selected the countries in which the GM cowpea would be tested, namely, Nigeria, Ghana and Burkina Faso. In Nigeria, the research was led by IAR in partnership with the AATF and other collaborators, including CSIRO; Purdue University, USA; the Network for Genetic Improvement of Cowpea for Africa; the Programme for Biosafety Systems, facilitated by the International Food Policy Research Institute; and IITA (IITA News, 2019). The Rockefeller Foundation and USAID funded this cowpea transformation project (Fatokun, 2009).

Far from being an initiative marked by the active involvement of local farmers, their organisations and others knowledgeable about the complexities involved, this cowpea intervention was driven by a network of institutions in the transnational biotech industry. In South Africa, the Cry1Ab Bt gene has been discontinued since the same Bt gene, used in cultivation of Bayer's maize (MON 810), resulted in huge pest resistance and infestation. What is notably absent from the biotech discourse is the existence of less invasive biological treatments for maruca and the other pests that attack cowpea, treatments which could be developed further

for use with cowpea (ACB, 2015).

IAR's field trials of GM crops used the following criteria for selecting participants: "farmers that are well experienced and have stayed for a very long time growing cowpea".[29] None of the field trials of GM cowpea with farmers included women, despite women cowpea farmers being estimated by the researcher to comprise roughly a third of all cowpea farmers in the North. The fact that this was not viewed as a problem points to the malestream tendency to regard the significant population of farmers as those growing crops for cash—largely men—as opposed to those growing them for subsistence—largely women. Research is clearly needed to establish what prevails on the ground.

At the tail end of each trial year, IAR researchers invite farmers to identify the varieties they would like to plant. Most of these farmers are men; only about one in four are women. Women are invited to these sessions "because women are the ones that know better in terms of processing".[30] While it is generally accepted that women are predominantly involved in cowpea processing, their exclusion from the field trials does raise the question of what is counted as "experience" in cowpea farming, as opposed to processing. Were women cowpea farmers' experiences with subsistence production not considered relevant, even though women are likely to have "stayed for a very long time growing cowpea?" The more significant question, however, is the meaning of "inclusion"—a point that is more often raised in the political sphere (see e.g. Hassim, 2005; Salo, 2005). Given the terms of inclusion in this instance, women cowpea farmers' participation in the field trials would not have erased the problematic character of the development of GM cowpea in Nigeria and within that, the role of field trials. In the next section, I turn to the space for resisting GM crops in Nigeria.

Resisting Genetically Engineered Crops in Nigeria

One of the most active campaigners against GM crops in Nigeria was Juliana Odey, otherwise known as Mama Cassava; she had grown cassava for over a decade. Odey was the Cross River State Coordinator of the Cassava Growers Association of Nigeria and later became a member of its Board of Directors. She was actively involved in mobilising rural women over the need to cultivate cassava and its benefits (Bassey, 2013). Her activism seemed to be grounded primarily in her agrarian status, not necessarily in articulating gendered dimensions of this experience. Odey was determined to attend the Public Hearing on the Biosafety

Bill, organised on 9 December 2009 by the Joint Committee on Science and Technology and Agriculture, of the National Assembly in Abuja. "She has never flustered in saying LOUD and CLEAR that 'Nigeria and indeed the whole of Africa does not need GMOs!' Farmers can feed the world and she is ready to galvanize women in Nigeria to campaign against GMOs" (*ibid*.). Drawing on generational politics, Odey told legislators on one occasion at the National Assembly, "You are my children, listen to me, don't give us poison".[31] As Odey was an elderly woman, National Assembly members felt obliged to listen, even if they did not like what she had to say.[32] Sadly, Juliana Odey died on 10 December 2013 (*ibid*.).

The leading civil society organisation challenging the promotion of GM crops in Nigeria is Health of Mother Earth Foundation (HOMEF), an ecological think tank "advocating for environmental justice, climate justice and food sovereignty in Nigeria and Africa" (HOMEF, 2018: 4). HOMEF's pan-Africanist agenda is clear from its tracking of activities related to food politics in other African countries, particularly resistance to GM crops, and circulation of this information in its awareness raising work. The organisation's political perspective is that exposing the systemic roots of environmental and food challenges requires the "scaling up of class struggle through the globalisation of peoples as against the globalisation of capital" (*ibid*., 7, 9). The "exploitation of nature" is viewed as "a reflection of the unjust relations between people and the social, political, gender, economic crises in society" (*ibid*., 5). HOMEF works in alliance with several women's organisations within the coalition that has formed around HOMEF's activities. This is a broad-based coalition, comprising environmental justice groups, health organisations, poverty eradication groups, farmers, student and youth groups, community development organisations and faith-based organisations. The involvement of women and their organisations in the coalition and in HOMEF's activities is important in itself, but it is not synonymous with these activities being informed by feminist analysis and an awareness of gender relations in agricultural crop production.

It is instructive to consider what such a feminist analysis might look like. GM crops pose several threats to smallholder farmers' abilities to make a living but not all smallholder farmers will be affected similarly. While activists in the Nigerian context have linked considerations of food security to farmers' livelihood security in terms of potential economic, health, environmental and ecological risks, what

has not been addressed are the social relations of production and their gendered dimensions. Feminists have drawn attention to ways in which livelihood activities and outcomes for women and men are inextricably connected to land and labour relations. Livelihood outcomes are gendered in diverse ways, shaping the divisions among and within livelihoods, burdening women disproportionately with unpaid domestic and care work, producing inequalities in access to, and the control of, land and labour, and perpetuating gender inequalities in livelihood outcomes through policies (social and economic) as well as institutions (such as markets and households) (Tsikata and Amanor-Wilks, 2009; Tsikata, 2009).

In the case of smallholder farming and subsistence production, women's labour is a critical resource given the small size of plots and basic equipment used for farming (Tsikata, 2009). When the use of GM crops and/or the accompanying agro-toxics (herbicides and pesticides) affect crop yields and/or biodiversity on family plots, and households have insufficient land for household subsistence, women may be caught between competing demands—the need to earn income and the need to maintain subsistence production as well as increase domestic and care work to ensure household survival. When women do not own the land on which they farm, the death of their spouse leaves them open to physical and economic abuse. Gender analysis would highlight the differences among women shaped by their relations with men, kin, intra-household dynamics, property rights and access to, and control over, resources. The more precarious women's working conditions become, whether in the field or in the office, the more vulnerable women become to sexual harassment and sexual violence, notably by those in authority (Henry and Adams, 2018). Efforts to counter the hegemony of GM crops in current agricultural policy would benefit from research that addresses the implications of these interwoven power relations for women.

Resistance to GM crops in Nigeria has involved collaborative efforts at multiple levels: engaging the state through legal and policy advocacy, movement building by mobilising communities against GM crops, and public education on GM technology and GM crops. HOMEF has been a key force in these efforts, working closely with the Alliance for Food Sovereignty in Africa (AFSA) and the GMO-free Nigeria Alliance. HOMEF's knowledge production supports its activities at these different levels.

Activists have stressed that the regulatory context in which GM crops are being promoted and consumed is marked by official disregard for food systems, biosafety and people's wellbeing. The general weakness of the regulatory framework has been emphasised by HOMEF's (2015) review of Nigeria's National Biosafety Management Agency Act, 2015. The overall orientation of the Act is that there is no need to question whether GMOs are an appropriate development for the country or not. HOMEF's starting point, however, is that there should be "a national discussion on the Big Question: Do Nigerians want GMOs or not?" (*ibid*., 10). The Act has no checks and balances against the Agency's absolute decision-making power, and no oversight from a parent ministry. The Governing Board is constituted by representatives of the private sector, National Biotechnology Agency, the Federal Ministry of Trade and Investment, and the Biotechnology Society of Nigeria. These are the very entities whose activities, technology and products the law should be regulating. NGOs, meanwhile, are to be represented by one member only while farmers and consumers are excluded (HOMEF, 2015).

Policy advocacy has taken the form of written objections to Bayer's application for confined field trials of GM maize in Nigeria (HOMEF and ERA/FoEN, 2016b; Ezeamalu, 2016a) and to Bayer's application for the release of GM cotton in the country (HOMEF and ERA/FoEN, 2016a). Concerns were raised on the grounds of threats to health, environmental justice, social and economic inequalities, and numerous issues relating to safety and risk assessments (HOMEF and ERA/FoEN, 2016a and 2016b; Ezeamalu, 2016b). Over 70 organisations supported the objection on maize; on cotton, over 90. Relatively few groups work actively to counter GMOs, however, given the technical nature of the knowledge required. Yet many people are concerned and want more information: "when people have gotten to know about it, the response has been massively against GMOs".[33]

Activists have also stressed that policy alternatives to the current mode of practising agriculture would do well to address the needs that farmers have identified for themselves—more effective storage, improvements to agricultural production, more food processing, and more seed banks. Although there are some seed banks in place, they are seriously underfunded.[34] Larger ecological problems, such as desertification in northern states have to be treated as such; they will not be solved by the commercialisation of GM crops. Traditional farming practices, such as intercropping, should be recognised as agroecological practices, which

are superior to the use of GM technology in agriculture because "agroecology promotes the dynamic existence of the biosystem and the ecosystem".[35]

HOMEF's mobilising of farmers and rural communities has been ongoing since 2005. A rally in the capital, Abuja, on 17 December 2018 drew hundreds of people in protest against the uncontrolled entry into Nigeria of GM crops and products. The organisers contrasted the latter with Tanzania's inspirational decision in November 2018 to immediately end all ongoing field trials of Monsanto's GM lines in the Water Efficient Maize for Africa project and to destroy their "remnants". The project was carried out by national research centres and supported by the Gates Foundation; it was terminated for its illegal use in pro-GM propaganda (ACB, 2018). The Abuja rally aimed to renew calls for a ban on GM crops and products in Nigeria, and push for action to protect food systems and biosafety more effectively (HOMEF, 2019).

Public education has been a focus not only for HOMEF but also for groups such as the GMO-free Nigeria Alliance as well as the Alliance for Food Sovereignty in Africa. The audiences of strategic interest are the media, farmers, and lawyers, since these are all constituencies that need to be critically informed about GM technology and the implications of promoting GM crops in Nigeria.[36] Critical biotechnology scientists are also involved in using the media—radio and TV—to engage members of the public. Biotech corporations have huge resources which they use to travel deeply into rural areas, offering farmers free GM seeds and thus locking them into GM crop usage. This accentuates the need for farmers to be adequately informed so that they recognise when they are being offered GM seeds and are aware of the associated risks.[37]

International networking and action on food governance via the UN system is another arena of resistance to the promotion of GM crops in Nigeria. AFSA is a network of networks, present in 52 out of the 54 countries in Africa, and recognised by the UN. The principle of "food sovereignty", first articulated by the peasant movement, La Via Campesina, makes explicit the power relations inherent in decisions and practices concerning who eats what food. By contrast, "food security" is about putting food on the table, not about the right to determine the process of getting food to the table. AFSA holds conferences and meetings to discuss food systems, community rights and GMOs. Membership within Nigeria comprises youth groups, women-led farmers' organisations such as the Cassava

Growers' Association, and women's environmental organisations, groups which also support HOMEF's activities. Internationally, AFSA has alliances with La Via Campesina and the World March of Women, and also works with SOFI (State of Food Insecurity), whose African chapter is in Kenya.

Activists are also promoting awareness of new and more dangerous forms of biotechnology. Gene editing techniques are being used to engineer even more invasive forms of genetic modification—gene drives—which will create new gene drive organisms.[38] The process involves gene drives consistently forcing their genetically-engineered traits onto future generations of that species by replacing all offspring that lack genetically-engineered traits. Gene drives are currently being promoted for disease control, mainly of malaria, in West Africa. The hidden commercial goal, however, is agribusiness where numerous patents are awaiting conclusion. Publicly-announced gene projects in the US are led by the US government's military research agency (Defence Advanced Research Projects Agency), the Gates Foundation, the Tata Trusts, and the Facebook-backed Open Philanthropy project (ETC Group, 2018a). NEPAD supports the development of gene drive organisms for malaria treatment and has received funding for such work. Given that gene editing technology is even less well understood than first generation genetic modification, and the potential risks are considerably higher, a wide range of African CSOs have called on African governments to support the moratorium on the development and use of gene drives (ETC Group, 2018b). Dependence on risky technologies that extract profit at the expense of genetic resources, and women's labour and wellbeing, while enabling the militarisation of food and agriculture, is simply unacceptable.

As we work to resist the hegemony of GM crops and technology, it is worth reflecting on Andrews and Lewis' (2017: 9) reminder that "there is no social movement and political space that does not include food. By unearthing the ways and assumptions around food in these spaces, we create a lens to see which food is produced, who cooks and feeds us, who organises the food and who pays for it". Food provides a route to examining the workings of power with regard to patriarchy, capitalism and the ecological crisis in the contemporary neoliberal order. Embedding such questions about food in multiple movements and spaces affords the opportunity to explore connections to life and each other, and their associated meanings in the process of "reclaiming seed, land, body and agency" (*ibid.*, 7).

Concluding Thoughts

The speed at which genetic engineering, in its first generation and emergent forms, is proceeding in Nigeria makes it imperative to open up larger societal conversations about the industrialisation of genetic resources. What does it mean for government to make top-down policy decisions of this sort without consulting local farmers, food crop growers and others working the land, particularly women? What are the implications for governance when corporate interests are being served in the name of "development"? What informs the choice of crops selected for genetic modification and what are the implications when those selected are food crops like cowpea and cassava, which predominate among the crops that women grow? Addressing these questions necessarily entails also opening up questions about social and economic inequalities, particularly rural underdevelopment—the systemic problems that a narrow technicist focus on biotech avoids.

The transnational mesh of biotech corporations, private foundations, international development agencies, scientific institutions and networks, and African governments supporting the promotion and development of GM crops constitutes a formation in which component elements are positioned in differing relations of power relative to one another. While the relations among many, if not most of these different elements are generally co-operative, in some instances they are decidedly conflictual, as we saw in the case of Tanzania. Recognising the specificities and complexities of these diverse contexts and conditions is necessary to identify potential spaces for exposure and contestation.

The assumption that science and technology are sufficient to provide solutions to complex problems is misguided. Questions such as what kinds of technology would support positive change or what kinds of science would most benefit different categories of women as well as men are neither scientific nor technological questions. The broader picture of today's realities is one of massive social change, growing national and global inequality, and shrinking resources, which combine to produce ever increasing social dislocation. Engaging these realities requires a combination of critical feminist thinking and a broad understanding of changes across time and space, within and across local, regional, continental and transcontinental boundaries, with eyes open to the invigorating possibilities of alternative futures. This is the kind of cross-bordered feminist knowledge production and action that we need to inform our quests for more

liveable lives and wellbeing—journeys in which gender justice lies at the heart of social and economic transformation.

Endnotes

1. Adapted from a statement by Dr. Ifeanyi Casmir, Dept. of Veterinary Microbiology, University of Abuja, in an interview on 8 November 2018: "Our traditional seeds are superior to what is being handed down to us, we are gradually with our eyes open, entering into slavery ..." All respondents interviewed consented to their views being recorded and used in this study.
2. I would like to thank members of the African Feminist Reflection and Action Group for birthing the overall project of which this study is a part. Thanks are particularly due to Akua Britwum and other members of the Methodology Workshop who gave feedback on the original idea, and Tina Andrade of Friedrich Ebert Stiftung for her immense support. Jibrin Ibrahim, my life partner, inspired numerous discussions on GM crops in Nigeria, helped me with contacts for interviews, and participated in those held at the Institute of Agricultural Research, Ahmadu Bello University, Zaria. Kingsley Umuenyen provided research assistance and transcribed the research interviews.
3. I use the phrases "genetic modification" and "genetic engineering" interchangeably.
4. Centre de coopération internationale en recherche agronomique pour le développement.
5. Interview with Dr. Mohammed Lawal, IAR, Ahmadu Bello University, Zaria, 18 October 2018.
6. https://fmard.gov.ng/the-green-alternative/
7. See endnote 1.
8. The Dakar Declaration was issued by the women-led campaign "We are the Solution: Celebrating African family farming". Leaders from 12 rural women's associations from six West African countries comprised the Women's Group which issued the Declaration.
9. Bill & Melinda Gates Foundation. How We Work, Alliance for a Green Revolution in Africa. Available at https://www.gatesfoundation.org/how-we-work/resources/grantee-profiles/grantee-profile-alliance-for-a-green-revolution-in-africa-agra
10. AGRA Nigeria. Available at https://agra.org/where-we-work/nigeria/
11. https://www.usaid.gov/who-we-are/mission-vision-values
12. NGICA, no date. "Network for the Genetic Improvement of Cowpea for Africa – NGICA". Available at https://www.entm.purdue.edu/NGICA/detail.html
13. https://partnerships.usaid.gov/partnership/genetic-improvement-cowpea-ngica
14. Interview with Dr. Mohammed Lawal, IAR, Ahmadu Bello University, Zaria, 19 October 2018.
15. https://www.aatf-africa.org/aatf_projects/ofab/

16. Ibid.
17. Ibid.
18. https://www.ofabnigeria.com/about-ofab/
19. Interview with Prof. Ibrahim Abubakar, Director, IAR, Ahmadu Bello University, 19 October 2018.
20. Interview with Nnimmo Bassey, Executive Director, HOMEF, 15 October 2018.
21. Interview with Dr. Ifeanyi Casmir, Dept. of Veterinary Microbiology, University of Abuja, 8 November 2018.
22. Interview with Dr. Ifeanyi Casmir, Dept. of Veterinary Microbiology, University of Abuja, 8 November 2018.
23. This is an international agreement regulating the safe transfer, handling, use and transboundary movement of GMOs.
24. OFAB, no date. "Information About GMOs", Open Forum on Agricultural Biotechnology in Africa, Nigeria Chapter.
25. Interview with Dr. Ifeanyi Casmir, Dept. of Veterinary Microbiology, University of Abuja, 8 November 2018.
26. Interview with IAR Director, Prof. Abubakar Ibrahim, Ahmadu Bello University, Zaria, 19 October 2018.
27. Interview with Dr. Ifeanyi Casmir, Dept. of Veterinary Microbiology, University of Abuja, 8 November 2018.
28. Interview with IAR Director, Prof. Abubakar Ibrahim, Ahmadu Bello University, Zaria, 19 October 2018.
29. Follow-up interview with Dr. Mohammed Lawal, IAR, Ahmadu Bello University, Zaria, 19 October 2018.
30. Ibid.
31. Personal communication, Mariann Bassey-Orovwuje, Chair, AFSA, 17 June 2020.
32. Interview with Mariann Bassey-Orovwuje, Chair, AFSA, 22 October 2018.
33. Interview with Nnimmo Bassey, Executive Director, HOMEF, 15 October 2018.
34. Interview with Gbadebo Rhodes-Vivour, Convenor of GMO-free Nigerian Alliance, 8 November 2018.
35. Interview with Dr. Ifeanyi Casmir, Dept. of Veterinary Microbiology, University of Abuja, 8 November 2018.
36. Interviews with: Mariann Bassey-Orovwuje, Chair, AFSA, 22 October 2018, and Gbadebo Rhodes-Vivour, Convenor of Nigerians Against GMOs, 8 November 2018.
37. Interviews with: Mariann Bassey-Orovwuje, Chair, AFSA, 22 October 2018, and Gbadebo Rhodes-Vivour, Convenor of Nigerians Against GMOs, 8 November 2018.
38. Interview with Dr. Ifeanyi Casmir, Dept. of Veterinary Microbiology, University of Abuja, 8 November 2018.

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