Genetically Modified Organisms (GMOs) – Part I

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Introduction

The phenomena and practice of improving crop and animal species seem germane to humanity across every known documented civilization. Some of these methods include cross and selective hybridization, grafting among others. Genetically Modified Organisms (GMOs) are unique in that certain desirable genes or protein sequences are deleted, inserted or reengineered from the same or different species into a new organism.1 It is estimated that nearly 90% of all soybeans, corn, and cotton cultivated in the United States are genetically modified.2 The introduction of GMOs) continues to generate global debate. For instance, the introduction of GMOs in the United States was fraught with many debates much as it is even now in Canada and Europe.3 Opponents have often contested that GMOs may affect naturally occurring organisms, become resistant to antibiotics and potentially affect the environment and even humans. Some have raised questions on bioequivalence and safety of GMOs to non-GMOs. It is thus not surprising that the introduction of GMOs continue to generate unprecedented controversies with scientific, ethical, and even legal dimensions.4

Recently, the Parliament of Ghana debated and passed the "Plant Breeders Bill Act 2013" which ostensibly authorized the Center for Scientific and Industrial Research (CSIR) to conduct field trials for three GMOs.5 These GMOs are cowpea, rice, and sweet potatoes. The rationale for genetically modifying these organisms is to address specific needs, including food security, nutritional enrichments, and protection of the environment.6 As anticipated, this generated substantial public outcry throughout Ghana and beyond. What is behind this global ambivalence toward the acceptability of GMOs? Are these scientifically, legally, and ethically justified?

Scope

This paper will examine the debates and the challenges on GMOs in general with cryptic references to the Plant Breeders Bill as a case study. I will examine some of these challenges through the acuity of some ethical concepts, such as the uncertainty theory in resolving disagreements, beneficence/non-maleficence, and justice. I will also attempt to propose some policy, legal, and ethical solutions.

The Debate on Genetically Modified Organisms (GMOs)

As indicated above, GMOs comprise an insertion of a particular gene of interest into living organisms or the deletion of a gene due to some desirable traits.7 Sometimes, a particular gene or protein sequence deemed obnoxious may be spliced or eviscerated from the host genome so as to attain the expression of certain characteristic or traits.8 Genetic modifications of organisms have a wide scope of applications especially in bioengineering of plants and animals for therapeutic, commercial, and other novel purposes such as pest and weed control.9 Some of these GMOs are Bt-corn, Atlantic salmon, and Bt-cowpea.10

The introduction of new genes into different organisms has degenerated into contentious debates. Indeed,

the hysteria of a new or "foreign gene" in a new host's genome makes it unfathomable to many people and also raises serious questions. But are these technologies safe? What is the threshold in defining these products as safe? Questions on the possibility of transgenic introgressions into wild varieties of certain organisms such as corn or soybean have been justifiably raised even though no conclusive scientific data has substantively proven it nor disputed the assertions to date.11 Furthermore, one of the major socio-economic aspects of the debate is that small scale farmers may perpetually rely on the big corporations for GMO seeds, which culminates in a high cost in production.

It seems society has trust in biotechnology products in general, but it is particularly ambivalent about GMOs. Some religions, especially of the Abrahamic traditions, have some dietary obligations enjoined on them. Some of these include the prohibition from eating pork. What arises is the question of whether or not a gene from a pig used to engineer a product such as a vegetable would constitute a transgression of these religious tenets? This is an important question in the debate prompting many to favor a complete labeling of GMO products.12 But does a particular gene in a genome define an entire organism? In view of these challenges, I will examine these questions with some ethical concepts. What about the socio-political context? It should be noted that, whereas in the US, most initiatives on introducing GMOs have been orchestrated by private companies such as Monsanto while in developing countries such as Ghana, the government has remained quiet on the introduction of GMOs.

Some Ethical Challenges and Analysis

One of the major challenges on the debate on GMOs is that there are many uncertainties or "disagreements".13 This is further exacerbated by the pervasive phenomena of conceptual, factual, and evidential disagreements on GMOs.14 The question that emerges herein is: what are the best and most certain ethical frameworks to use in analyzing the debate on GMOs, especially as there are many uncertainties and unanswered questions? Does any single ethical theory suffice in responding to the debates? If so, which one? What makes the debate on GMOs seemingly divisive both within the scientific community and the general public as a whole? Indeed as Beauchamp noted "neither [one] morality nor ethical theory has the resources to provide a single solution to every moral problem."15 Consequently, in this section, I will analyze these challenges through the nexus of the ethical framework of dealing with disagreements. 16

First of all, there are conceptual uncertainties or moral disagreements among scientists and even ethicists about GMOs.17 Some proponents postulate the argument that biotechnological innovations and the introduction of GMOs are good and novel human inventions in advancing the common good. Aligned with this is the idea that humanity has always improved living organisms in the past through methods such as grafting and domestication of wild crops and animals. Therefore, the introduction of GMOs is consistent with an intrinsic disposition of humans to improve naturally occurring living organisms. GMOs, such as the case of genetically modified cowpeas in Ghana, is to insure food security and enhance nutritional needs of people, and thus ameliorate the problem caused by the fact that nearly 30-70% of non-GMO cowpeas were lost during propagation and harvesting. Hence, the notion and the conception of resolving a seemingly significant natural problem should be accepted under the expediency of its novelty, rather than the presumption that GMOs are inherently bad.18 On the other hand, some have countered the above argument, suggesting that unlike other forms of biotechnological innovations such as crop and animal breeding, in GMOs, genes from unrelated species are introduced for specific purposes that may not be natural to the host organism(s).19 There is no certitude and data to substantiate the case that these new genes are substantively safe especially in the long term.20 Should the introduction of GMOs be halted until questions of uncertainty are addressed albeit resolved?21 This then leads us to the issue of disagreement based on insufficient information and evidence.22

The debate on GMOs is further compounded and enveloped with apparently insufficient information. Proponents of this view asserted that there are unreliable and insufficient data to make the case for GMOs. Furthermore, there seem to be many disagreements among scientists about some data on GMOs. 23 For example, some data suggests that GMOs are perilously invasive and may have altered other living organisms

within an ecosystem, including humans.24 Currently, the FDA has endorsed the production and the release of GMOs while the European Food and Safety Authority (EFSA) has adopted a precautionary principle and banned GMOs in Europe. 25 The crust of the issue is that these are two credible scientific organizations mandated to ensure food and drug safety but both have stark disagreements on the information on GMOs. Both the FDA and EFSA seem to agree on the lack of scientific certitude and insufficient biodata on the safety of GMOs.26 To buttress this argument, proponents agree with the WHO statement that GMOs "…are not likely to present risks for human health".27 Furthermore, the World Trade Organization's (WTO) Sanitary and Phytosanitary Agreement (SPS) article 5.7 inter alia indicates that:

"....in cases where relevant scientific evidence is insufficient, a Member may provisionally adopt sanitary or phytosanitary measures on the basis of available pertinent information, including that from the relevant international organizations as well as from sanitary or phytosanitary measures applied by other Members. In such circumstances, Members shall seek to obtain the additional information necessary for a more objective assessment of risk and review the sanitary or phytosanitary measure accordingly within a reasonable period of time". 28

Given the apparent insufficiencies of the information on GMOs, it begs the questions as to whether ethicists have any formidable grounds to assume a particular position to be accurate or good!

The third component to the uncertainty theory is based on the premise of factual disagreements. There is no doubt that there are many biodata on GMOs evidenced in the many scientific publications and peer reviewed information about scientific "facts" on the pros and cons of GMOs.29 On the contrary, some scientists have also demonstrated seemingly convincing biodata challenging and raising the question of safety of GMOs, allergenic reactions and eco-safety. For example, a seminal study conducted on the effect of GMO Bt-Corn on larvae and concluded that material from the bacterium Bacillus thuringiensis (Bt) are generally thought to have "although plants transformed with genetic negligible impact on non-target organisms, Bt corn plants might represent a risk because most hybrids express the Bt toxin in pollen, and corn pollen is dispersed over at least 60 metres by wind."30 On the contrary, six teams of scientists also demonstrated and concluded that the GMO corn did not pose any such risks!31 These two conclusions have tangentially demonstrated factual disagreements about the safety of GMOs. In the Ghanaian context, many opponents to the introduction of GMOs made cryptic references to this theory by suggesting that there are disagreements among scientists on the facts on GMOs hence it should not be introduced. But do GMOs actually cause harm or good? What is the factual evidence to substantiate these claims? In an attempt to respond to questions on uncertainty, I propose the ethical theory of beneficence among others.

The Right to Food Security and Socio-economic Justice

One of the seemingly cogent arguments is that GMOs will lead to food security, especially in the context of developing countries such as Ghana. Proponents have suggested that nearly 30-70% of all cowpeas were destroyed by the pod borer insect-maruca vitrata. This has caused substantial economic loss for producers and the general public. The new genetically engineered variety, Bt-cowpea presumptively has the potential for resistance to the pod borer, thus potentially saving millions of dollars in expenses on pest control. As the lead investigator, Atokple noted, "pod borer infestation is a major constraint to cowpea production in Africa".32 In addition, the proposed GMO sweet potatoes are purported to be nutritionally enriched with essential amino acids to curb the incidence of malnutrition. Thus the introduction of these crops will lead to greater nutritional value, bioefficiency and economic gains that will be of immense "benefit" to consumers. These benefits also include food security and sustainable production as producers may spend less maintaining their fields in terms of pest control.33

Another benefit is the environment. Bt-cowpea could lead to less application and release of obnoxious agrochemicals into the micro and macro ecosystems. This means, less damage to the ecology such as reducing water pollution and less harm to other micro- organisms on the fields where these crops are cultivated.

Furthermore, the GMO rice is purported to have been specifically engineered to optimize nitrogen intake to solve the challenges of hydromorphic fields caused by seasonal and excessive irrigations. But conspicuously missing from the debate are the possibilities of transgenic introgression into wild varieties of these crops or similar crops that could potentially cause serious environmental problems such as super weeds.34 Gene transgressions could be fatal if these "new genes" enter the food chain.35

On the contrary, it has been suggested that there are many "uncertainties" on the biosafety of these crops. Furthermore, the possibility of GMOs causing harm such as allergenic reactions is factually demonstrable. For example, in Brazil, a genetically engineered soybean enriched with methionine-rich 2S albumin from the nut Bertholletia Excelsa caused allergenic reactions during initial trials prior to being released.36 Because of this and others, some have called for field trials and human biosafety testing spanning a longer period of time in ensuring eco-safety and consistent with the ethical dictum non primum non nocere (above all cause no harm). Furthermore, there is the perceptual argument of gene linkage into the environments and crop mingling with non-GMOs, thus causing unintended harm.37

A preliminary conclusion from the beneficence argument is that the "benefits" as presented based on current biodata on GMOs (especially regarding the Bt-cowpea, sweet potatoes, and rice) seems to outweigh any "risks" or harm. Nonetheless, the potential for harm remains unpredictable.38

Conclusion

Despite these challenges, consumers still make decisions and choices about GMOs. Two questions emerge: Why choose or not to choose GMOs? An affirmation of the former implies accepting some of the potential risks in GMOs products. While an affirmation of the latter question might appear benign and precautionary, it nonetheless carries unintended consequences as well. Thus choosing GMOs or not implies some preponderance ethical calculi of risks. As a sequel to this piece, we will explore some other ethical perspectives such as the principle of double effect in response to these nagging questions with dexterity!39

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