Dr. Virginia Gichuru

Strathmore University

Nairobi, Kenya

vgichuru@strathmore.edu

Abstract

There is belief that the use of biotechnologies in combination with conventional plant breeding, can contribute to the food security of Africa. Some of these potential benefits of genetically modified biotech crops include tolerance to salinity, resistance to pests, and enhanced nutritional value. Nutritionally enhanced crops are important in developing countries to fight malnutrition and its related diseases. On the other hand the advent of biotech crops has been met with skepticism by different sectors of the public. People want to know whether these crops are safe, cheaper and more nutritious. However, informed decisions about their use have been left to individual countries. In Kenya, Genetically modified maize has been imported into the country to meet the current shortfall in the maize crop. This has been met with public outcry.

The purpose of this study was to examine the moral acceptability of genetically modified foods using the Aristotelian understanding of Ethics. This is method looks at the elements involved in any free human act and analyses the object, intention and circumstances surrounding such an act. In the case of genetic modification this is to ascertain whether such an action enhance the nature of man and his common good.

The approach used was to make use of secondary data source in order to understand the ethicalness of modifying GM foods based on Aristotelian Ethics

Results were analysed based on different scenarios labeled A-H. The moral object analysed in all the scenarios were the GM foods inserted with genes from plants,animals,bacteria or viruses so as to confer advantages to the modified crops such as drought, disease and pest resistance. The intentions were varied. For instance the intention of scientists would be to engineer food crops so as to acquire food security. This can be a morally good action since it enhances the human dignity. The circumstances surrounding such an action could be that some of these genes might be harmful to human beings and the environment because most times these genes are

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coming from non plants. The moral value of such an action is bad because it will affect human health negatively and hence go against the human nature.

The implications of this study indicate that the human aspect in Gm foods must be taken into consideration because it is the human person who adds to any aspect the ethical or moral dimension. Also Universities like Strathmore University, which has a strong background in Ethics should team up with other research institutes engaged in the production of GM products and ensure that these products are not only economically and technologically sound but also morally sound.

Keywords: Genetically modified foods, ethics, Aristotelian, object, intention, circumstances

Introduction

Ethics is a branch of Philosophy which studies free human acts from the point of view of their moral value (goodness or badness) in relation to man's last end (Debeljuh, 2006). Ethics is able to ascertain what man's final goal is and the type of behaviour that will lead him to that final goal. The final goal(s) should give person happiness (Debeljuh, 2006). On the other hand, bioethics, "which comes from two Greek words *Bio*, meaning life and *Ethos*-moral/behavior, refers to the study of life ethics. A word coined in the later part of the 20th century to describe the various rights and wrongs of new scientific and technological procedures and discoveries (in particular in response to human experimentation during World War II) which were seen to bear a direct and significant impact upon humane survival"(Mercer, 2012).

Various theories have been used to understand Ethics. "*There are four central contending positions in the arena of normative ethics: (1) a deontological view, rooted in Kantian rationalism or some form of contractarianism, which gives priority to the right over the good and places rules in a privileged place at the heart of normative theory; (2) a broadly consequentialist view, which places the notion of maximizing good states of affairs in the privileged place at the heart of normative theory; (3) virtue ethics, rooted in some broadly Aristotelian or Human conception of the virtues, which places the notion of a virtue and the companion notions of human flourishing or well functioning at the heart of normative theory;*

and (4) anti-theory with regard to ethics, which is skeptical of the ambitions of any of these views and skeptical especially of the claims of moral philosophy to be able to vindicate rationally some substantive conception of the good life for humans" (Macintyre, 2003).

If we observe the consequences of these foods using the consequentialist theory we realise that genetically modified foods (GM) have positive consequences such as enhancing food security and providing additional nutrients etc. However if we examine the intentions why these GM foods have been produced we realise that the intention may not always be upright in some cases. For instance it has been found that biotechnological corporations in charge of disseminating GM seed would like to control the industry due to the huge profit margins they are set to incur by becoming monopolies in that field. When a utilitarianist theory is applied to the moral acceptability of GM foods it could be said that if pleasure comes from the production and use of GM crops then they are acceptable. This would then ignore the intention for which they are engineered.

Philosophical basis of the moral acceptability of GM foods

In this paper I would like to examine the moral acceptability of GM foods using the Aristotelian understanding of ethics in line with the second paragraph of the Concept Note for Strathmore's 9th Ethics Conference call for papers. For Aristotle, ethics is based on achieving the chief good for man which he called eudaimonia ('happiness'). He said that eudaimonia is something that is "final and self sufficient and is the purpose or end that our human action tends toward.

> *"Verbally there is very general agreement; for both the general run of men and people of superior refinement say that it is happiness, and identify living well and doing well with being happy; but with regard to what happiness is they differ, and the many do not give the same account as the wise. For the former think it is some plain and obvious thing, like pleasure, wealth, or honour; they differ, however, from one another− and often even the same man identifies it with different things, with health when he is ill, with wealth when he is poor; but, conscious of their ignorance, they admire those who proclaim some great ideal that is above their comprehension (Aristotle:Nichomachean Ethics, Book I)."*

This eudaimonia refers to a condition of well-being and that one's life is in a state of flourishing. Aristotle discovered that flourishing is found by discovering the function that man uniquely performs and that sets him apart from other living creatures. Aristotle thought that man's function can neither be biological nor consist of perception, since animals and plants also do this. Aristotle affirms that it must consist in what is unique to us as human beings and that is the rational element.

> *"If this is the case, and we state the function of man to be a certain kind of life, and this to be an activity or actions of the soul implying a rational principle, and the function of a good man to be the good and noble performance of these, and if any action is well performed when it is performed in accordance with the appropriate excellence: if this is the case, human good turns out to be activity of soul in accordance with virtue, and if there are more than one virtue, in accordance with the best and most complete" (Aristotle:Nichomachean Ethics, Book I).*

Adopting this point of view, the paper will try to examine if GM foods enhance the nature of man by taking into consideration his rational nature (i.e. his ability to make choices) as well as promoting the common good of man.

> *"Every state is a community of some kind, and every community is established with a view to some good; for mankind always acts in order to obtain that which they think good. But, if all communities aim at some good, the state or political community, which is the highest of all, and which embraces all the rest, aims at good in a greater degree than any other, and at the highest good" (Aristotle, Politics, Book I).*

Anything that goes against his nature would be considered morally unacceptable. The common good can broadly be described as a specific "good" that is shared and beneficial for all (or most) members of a given community. In utilitarian ethics, the common good has been seen as a utilitarian ideal representing "the greatest possible good for the greatest possible number of individuals". But this contradicts what Aristotelian ethics describes as the common good. He defines the common good as the perfect goal of the state which requires an admission of the

individual's basic right in society. This basic right means the right of everyone to the opportunity to freely shape his life by responsible action, in pursuit of virtue and in accordance with the natural moral law.

The Moral Problem of GM foods

Therefore, in order to judge the morality of man's free human actions we have to begin by understanding that every human act begins from within the person, in their intellect and will, and is then made manifest in their external **behavior (Debeljuh, 2006).** The morality of an action refers to how the person tries to direct that act towards the final goal or not. In this case the final goal we shall refer to is the happiness of man and the common good. This largely depends on the object of the act itself and the intention of the person who does the act. The circumstances of the act will also affect its morality (Debeljuh, 2006).

> *"A voluntary action is one where the doer knows what he is doing. We now see that every accusation must be of an action affecting either the community or some individual. The doer of the action must either understand and intend the action, or not understand and intend it. In the former case, he must be acting either from deliberate choice or from passion (Aristotle Rhetoric)."*

The Moral problem of GM foods from the perspective of the object

Each voluntary act has a particular object or content that is known and willed by the person who acts. The moral object is not only the physical object but includes the relation of this object with the natural moral law (NML), moral virtues and the common good. The natural moral law has a principle which upholds that "good is to be done and promoted and evil to be avoided' **(ST I-II, 94, 2).** This principle formally governs practical reasoning. To determine what the proximate natural goods for man, Aquinas suggests that reason naturally apprehends as goods those objects that satisfy man's basic inclinations. On the lowest level are those physical goods that all beings incline to, such as self-preservation. Second are biological goods that men tend towards, as do all living things: the procreation and care of offspring, for instance. In the third and highest place he puts those values that satisfy man as a rational being: the knowledge of truth about God and the advantage of living in the society with other humans (ST I-II, 94, 2).

Moral virtues are also related to the good of the person and his happiness; they have an absolute value that cannot be manipulated without falling into moral guilt, just as the human person cannot be used as a means rather than an end. In this way then it is possible to understand that the physical object can have different moral objects. Depending on the way in which it is carried out; some ways may be coherent with man's final goal while others may not.

From the point of view of morality, the object will be good or bad depending on how the act contributes to the NML, the moral virtues of man and the common good. The intellect in man gets to know the possible object and judges whether it conforms or not to the final end of man.

Genetic modification or transgenics of crops takes place when only a small additional piece of information (foreign DNA/gene) is inserted into farmer preferred cultivars to control a specific trait within the selected cultivar. This foreign gene could be obtained from another plant, animal, viral or bacterial gene (Orton & Sexton, 2003). For example the introduction of bacterial genes into cash crops, to enhance their growth, nutritional value or resistance to pests, is becoming rather commonplace in plant technology. One example that has made frequent headlines was the introduction of bacterial genes for natural pesticides into plants, in order to eliminate the need for chemical pesticide use (Orton & Sexton, 2003). Genetic engineering as it is sometimes referred to involves the process of splicing of a well characterised chunk of foreign DNA containing a particular known gene within the chromosome of a host organism using a pair of molecular scissors called 'restriction enzymes'. Restriction enzymes cut DNA strands at specific restriction sites into specific DNA fragments so that they can be inserted and integrated into the host chromosome at the restriction sites. All this takes place within a relatively short period of time when all the resources required to perform the tasks are available. Through this process, genetically modified crops acquire genes that can now confer resistance against pests, diseases and adverse environmental conditions such as drought. These crops can also be improved so as to enhance the nutritional content as well as post harvest storage or give higher yield (Nap, Metz, Escaler, & Conner, 2003). From an ethical point of view the physical object of GM foods when looked at from all these enhanced qualities is good since it will provide a secure source of food and nutrients to man. Therefore this will help the common good since poverty is eradicated due to higher yields and more tolerant crops. For instance GM biofortified cassava has potential to solve the problem of micronutrient malnutrition prevalent among young children and women in

Africa Also GM cassava conferred with disease and pest resistance will increase cassava production as it is plagued by cassava mosaic disease (CMD) (Adenle, Aworh, Akromah, & Parayil, 2012).

Possible hazards of GM food for animals and populations exposed to a diet containing GM products include the potential negative effects on animal and human health resulting from the increase of anti-nutrients, potential side effects on human health resulting from the use of viral DNA in plants, possible transfer of antibiotic resistant genes to bacteria in gastrointestinal tract, and possible effects of GM foods on allergic responses(Dona & Arvanitoyannis, 2009).

A study was also done to investigate the potential effects on human health resulting from the use of viral DNA in plants. The virus used was the Cauliflower Mosaic Virus 35S promoter (CaMV35S). There was a lot of controversy concerning whether the highly infectious CaMV35S could be horizontally transferred and cause disease, carcinogenesis, mutagenesis, reactivation of dormant viruses and even generation of new viruses(Dona & Arvanitoyannis, 2009). CaMV found in normal foods was not highly-infectious and could not be absorbed by **mammals (Dona & Arvanitoyannis, 2009).**

Even if these studies about the potential risks of GM foods have only been done in animals and not confirmed in humans, consumers still have some right to know when they are consuming GM food so as to make a more informed choice. Such a choice enhances the nature of the human person endowed with freedom and the capacity to choose because of his rational nature.

The Moral problem of GM foods from the perspective of intention

The intention of the moral act is the objective towards which the person directs his acts. (Debeljuh, 2006).The intention and the object together determine the substance of the moral act. The intention involves the subjective element of the moral act and it involves considering the interiority of the person who is acting. This is what converts the physical object into a moral object. Every human action has an intention although it is possible to think of acts whose object, in themselves are neither good nor bad. In practice there are no morally indifferent acts (Debeljuh, 2006).

Every object that is desired in itself and not in function of this final goal which the person hopes to attain becomes bad because it lacks the due commensurability with the final goal (NML, moral virtues and the common good) which are the primary basis of all morality (Debeljuh,2006).

Intention of companies that engineer GM foods

The moral object of GM foods can be examined by looking at the intention of the scientists who engineer them. A study was carried out to check intentions of some scientists who engineer GM foods. It was found that they engineer these GM foods for the advantage of the consumer/farmer. The scientists desire to see improved crop protection through the introduction of resistance to plant diseases caused by insects or viruses as well as increased tolerance to herbicides and improved nutritional status ("WHO | 20 questions on genetically modified foods," undated). For example, insect resistance was achieved by incorporating into the crop the gene for toxin production from the bacterium *Bacillus thuringiensis* (BT). The toxin was used as a conventional insecticide in agriculture and was safe for human consumption. GM crops that permanently produce this toxin have been shown to require lower quantities of insecticides in specific situations, e.g. where pest pressure is high ("WHO | 20 questions on genetically modified foods," undated).

This intention of the aforementioned scientists can be morally evaluated as good since they were interested in helping farmers especially poor resource farmers achieve the common good. However, insertion of foreign genes has to be critiqued further. Does the insertion of bacterial or viral genes cause health problems in humans who consume these crops? In this particular case, the intention is somehow modified by specific circumstances which can affect its morality.

There are many multinational corporations which produce GM foods and are in control of the seed market. These corporations are Monsanto, Syngenta, Bayer Crop Science and DuPont (Orton & Sexton, 2003). Some 91% of all GM crops grown worldwide in 2001 were from Monsanto seeds. Through linking its chemicals to seeds via GM technologies, it was able to extend its markets for herbicides and pesticides(Orton & Sexton, 2003). Specific research offers useful moral insights into the intentions of such companies. One explicit intention, and which has been dubbed unethical by the Food and Agricultural organization, is the creation and sale of

Genetic Use Restriction Technologies (GURTs). These technologies produce sterile seeds which result in no yields if planted from one year to the next and thus making farmers highly reliant on such firms (Orton & Sexton, 2003). Syngenta and Monsanto, which have both patented Terminator Technologies, promised not to commercialise such seeds after public outcry.

Another variant of GURT is the T-GURTs also dubbed as 'Traitor Technology', Seeds produced through such processes require chemical triggers to switch on or off traits in the plant [i.e. the crop's basic functions – germination, flowering, fruit ripening, sprouting and immune deficiency – depend on external chemicals]. T-GURTs promises rich rewards for corporations because they can engineer crops to respond only to their particular brand of agrochemicals(Orton & Sexton, 2003).This would result in farmers, being faced with greater dependency on such biotech corporations, which result in less choice and less seed security. One can argue that, as long such seeds make farmers captive to particular firms and thus limit their choices, they become unethical. Civil society organizations (CSOs) maintain that the right to adequate food requires food to be culturally acceptable, free from adverse substances and accessible in sustainable ways (Orton & Sexton, 2003).

Consumers 'Intention

The intention why consumers would purchase GM foods from supermarket shelves can also be examined. Some studies show that they seem not to have a direct intention for preferring these foods over organic grown foods. A study was done in Uganda by Kikulwe, Wesseler and Falck-Zepeda(2008) which determined consumer perceptions towards Genetically Modified Banana (*Musa spp.) .* The survey revealed that the majority of the respondents chose to buy GM banana at the same price as the non-GM banana on condition that GM banana was more nutritious, tasted better, or required fewer pesticides for its production. A substantial number of consumers expressed concerns about the technology in relation to food safety, global disasters and health risks. A similar concern was reported especially in the European Union (EU). Rural consumers were more likely to buy GM bananas compared to urban consumers if the quality of the banana improved. Urban consumers showed slightly more concern about the likely negative effects (both food and environmental, and health) associated to GM technology than rural consumers. The same study revealed that gender did not influence benefit perception; college and university graduates were found to be less likely to buy GM banana compared to others, while respondents

with university and secondary education showed more concern about food/environment and health safety of GM foods than the rest. Additionally, consumers with low income were slightly more likely to buy GM food and also showed less concern about the negative effects of the technology compared to the high income earners. Had the nutritious quality of the banana improved, at least 88% of respondents would consume GM banana regardless of whether they produced, sold or bought bananas (Kikulwe et al., 2008).

A study in Kenya indicated that most consumers had only a speculative understanding(guess) about the benefits or possible harmful effects of these foods(Simon Chege Kimenju & De Groote, 2008). For instance 40% of the respondents thought that people could suffer allergic reactions after consuming GM foods while 35 % feared that their consumption could lead to an increase in antibiotic resistance. Hence the moral value of the intention of consumers to buy GM foods could not be classified because of either uncertainty of whether it was culpable or inculpable ignorance. However looking at the positive reasons why the consumers would buy GM foods, the study indicated that they would do so if this food was better tasting and high quality than conventional crops(Simon Chege Kimenju & De Groote, 2008).

The Moral problem of GM foods from the perspective of circumstance

Circumstances are different factors or accidental aspects of the object or of the intention of the subject which affect the goodness of the action in some way. Human acts do not receive all their goodness from the moral object, rather it also comes from the circumstances which are like accidents that surround a moral action and can modify its object (Debeljuh, 2006).If the human act is good in its object and its intention, the circumstances can increase or decrease its goodness, and they can even come to transform a good act into an evil one.

The circumstances which surround GM foods are claims that these crops can eradicate hunger by increasing yield and ensuring also other nutrients. There is evidence to show that GM crops are resulting in increased crop yields, increased farm income, health and environmental benefits associated with GM crops(Adenle, Aworh, Akromah, & Parayil, 2012). Out of 15.4 million farmers that planted GM crops in 2010, over 90% (14.4 million) were resource-poor farmers in developing countries, including three African countries (Burkina Faso, South Africa and Egypt),

that benefited from the adoption of GM crops(Adenle et al., 2012). This enhanced, in some way, the common good since citizens were able to obtain enough food for their sustenance.

However adoption of GM seed might affect the gene diversity which farmers have safeguarded for generations. This could threaten to reduce the agricultural and crop diversity that are the basis of poor farmer livelihoods and developing country's food sovereignty. Three-quarters of the original varieties of agricultural crops have been lost from farmers' fields since 1900 as industrial and export-led agriculture has encouraged the widespread monoculture cultivation of a few crop varieties for a more uniform global market. GM crops threaten to erode biodiversity still further (Orton & Sexton, 2003). This would have harmful effects to the environment since a wide biodiversity offers more options to crop disease resistance. As such, a narrow biodiversity may have a negative impact on future generations. In this scenario, to some extent, the moral value can be considered as bad since the common good is not enhanced.

As regards issues facing developing countries, GM foods can be viewed as ineffective in tackling the underlying political and economic causes of food insecurity: poverty and inequality. These GM technologies do not address the essential constraints facing poor farmers including lack of access to: land, water, energy, affordable credit, agricultural training, local markets, decent roads, grain stores and infrastructure(Orton & Sexton, 2003) . In fact, GM could be disastrous for small-scale farmers as the costs are much higher and they risk falling into debt. This can be seen, from this view point, as morally unacceptable.

Another circumstance worth examining is that GM crops have been known to pose threats to other plants and insects. These GM crops can cross pollinate with non-GM plants thus endangering diverse original varieties, particularly in developing countries. Such crops would require bigger and more frequent doses of chemicals and insecticides as weeds and insects develop resistance to chemicals. This may threaten beneficial insects and thus disrupt natural pest management systems, as a consequence would cause harmful effects to the environment. Therefore from a moral point of view, in the case of cross pollination, GM foods can be bad due to extra expenses and expertise needed.

Another circumstantial issue of primary concern is inexistence of regulatory frameworks and capacity to develop such frameworks especially in developing countries. An example is Zambia where one person, who had no previous experience in developing national policies was in-charge of drafting the national biosafety policy("Governing the GM Crop Revolution: Policy Choices for Developing Countries - Robert L. Paarlberg, Peter Gruhn, Francesco Goletti, Montague Yudelman - Google Books," n.d.) . This can lead to situations where citizens consume GM foods which are unsuitable. There is need to have various mechanisms in place so as to further evaluate the moral acceptability of GM foods based on what the likely effects on the environment and human health could be **(S. C. Kimenju, De Groote, Karugia, Mbogoh, & Poland, 2011).**

In 1996, when the "mad cow" disease crisis hit Europe, there was a ban on meat importation into the EU. In 1997, the European governments began imposing separate labeling requirements on GM foods to ensure that consumers were informed when purchasing foods with GM content. This was a morally acceptable way of acting consistent with enhancing the common good of the country. In 1998, the EU blocked the registration of any new varieties of GM crops as well as banned imports of foods ("Governing the GM Crop Revolution: Policy Choices for Developing Countries - Robert L. Paarlberg, Peter Gruhn, Francesco Goletti, Montague Yudelman - Google Books," n.d.). They were acting in a precautionary way even if they had no scientific evidence that any GM crops on the market were not safe for human consumption or for the environment.

In Kenya all potential GM foods are being grown in controlled field trials so as to analyse the possible effects that they may have to the environment (personal communication). This is ethically upright since the government is interested in the common good of the people by safeguarding them from likely harmful effects. Many developing countries are more inclined to view GM crops as too novel so they need cautious biosafety considerations. Under such approaches, the government would slow down or hold back on the field testing or commercial release of GM crops not just to avoid biosafety risks that are known and have been demonstrated, but also to avoid some risks that may not yet be known or are still undemonstrated. However the problem with this approach is that when an emergency arises, risk assessment studies are not in place to assess the viability of such imports.

Circumstantial cases during times of food crises

A problem arises when biosafety policies, such as the Kenya Biosafety Act, are ignored so as to solve an emergency. This happened in 2012 when the government imported GM maize so as to make up for the shortfall in production. The intention of the government was to import GM maize to feed starving populations. The intention of alleviating hunger was morally upright since the implicit intention was to help people facing starvation. However, in such a circumstance, the National Biosafety policy was not followed. The overall good value of the action by the government to import GM maize was vitiated since it had ignored the Biosafety Act.

Not many countries are using GMOs in agricultural production around the world due to health and environmental concerns associated with the application of GMOs **(Adenle, 2011)**. The USA is one of the few developed countries growing GM crops on a commercial basis. More than 70 percent of some foods in the USA contain GMOs yet no American citizen or others that have consumed their foods have been confirmed seriously ill or dead as a result of GMO consumption **(Adenle, 2011)**.

General moral parameters and procedures needed to determine the likelihood of gene flow
Certain parameters such as Gene flow indices or botanical files are used to give an indication of the likelihood of a given species to hybridise with wild relatives and the impact this may have. Botanical files indicate the likelihood of gene flow from a particular GM crop plant to its wild flora, but ignore the potential impact of the transgene on crop and recipient wild relative. Therefore, botanical files have to be combined with knowledge about the transgenes used for transformation and the particular transformation event (Conner, Glare, & Nap, 2003) .

Horizontal gene flow refers to a gene transfer, usually through pollen, from cultivated species to their wild relatives (and vice-versa) (Conner, Glare, & Nap, 2003) .

This may happen with either conventional or genetically modified plants. However, many of the world's major food plants are not native to the areas where they are grown and thus lack close

wild relatives that would be needed for gene flow to occur. For example, potatoes (which originate in South America) and maize (originating in Mexico) have no wild relatives in Europe. In such cases, horizontal gene flow to wild relatives is impossible **(Green Facts on Health and the Environment, n.d)** In the USA, cotton and maize have no wild relatives, whereas sunflowers squash, and radishes do, making the latter possible candidates for gene flow **(Green Facts on Health and the Environment, n.d)** In general, gene flow between cultivated plants and their wild relatives is not considered an environmental problem unless it leads to undesirable consequences.

Procedures and international guidelines for the assessment of GMOs are well developed for food safety but not for environmental impacts. For instance the FAO/WHO Codex Alimentarius Commission provides an international forum for developing food safety guidelines **(Green Facts on Health and the Environment, n.d).** In the absence of international guidelines, environmental impact assessments differ in: the interpretation of data and of what constitutes an environmental risk or harm; the basis for comparison used: comparing the use of genetically modified crops either with conventional agricultural or with non-cultivated environments; the extent to which small-scale laboratory and field trials are valuable and can be used to extrapolate large-scale effects.

The scientific community recommends more research and better monitoring regarding post-release effects of genetically modified crops.

Discussion

From what has been pointed out earlier, what determines the moral value of an action is the object. However the intention and the circumstances are also important since they modify the overall morality of the act. The table below presents an analytical summary of the overall value of GM foods.

Table 1: Analysis of the overall moral value of GM foods using an Aristotelian moral basis

Scenario	Physical object	Moral object	Intention	Circumstances	Overall moral value of action
A	GM food (good)	GM foods have been inserted with genes from plants, animals, bacteria or viruses that confer advantages such as drought, disease and pest resistances (good)	Scientists will engineer these crops so as to provide food security(good)	Some of these genes may be harmful because they are coming from non plants (bad)	-Bad(vitiates moral goodness)
B	GM food (good)	GM foods have been inserted with genes from plants, animals ,bacteria or viruses that confer advantages such as drought, disease and pest resistances (good)	Biotechnology corporation want to maximize profits through creation of monopolies (bad)	Increase poor farmers' dependence on these corporations (bad)	-Bad(vitiates moral goodness)
C	GM food (good)	GM foods have been inserted with genes from plants, animals	Biotechnology corporations in	-These genes with terminator	-Bad(vitiates moral goodness)

Scenario	Physical object	Moral object	Intention	Circumstances	Overall moral value of action
		,bacteria or viruses that confer advantages such as drought, disease and pest resistances (good)	order to be monopolies sale seeds with terminator technology (bad)	technologies could result in farmers loosing the genetic diversity of their crop (bad)	
D	GM food (good)	GM foods have been inserted with genes from plants, animals ,bacteria or viruses that confer advantages such as drought, disease and pest resistances (good)	Farmers would like to enhance food security by ensuring crops are improved for qualities such as nutrients, drought, insect and pest resistances (good)	-These GM crops may affect the health and environment (bad)	-Bad(vitiates moral goodness)
E	GM food (good)	GM foods have been inserted with genes from plants, animals ,bacteria or viruses that confer advantages	-Consumers are looking for better taste and quality	-Consumers fear allergic reactions and antibiotic	-Bad and depends on whether allergic and antibiotic resistance

Scenario	Physical object	Moral object	Intention	Circumstances	Overall moral value of action
		such as drought, disease and pest resistances (good)	in GM foods (good)	resistance from these foods (bad)	is factual.
F	GM food (good)	GM foods have been inserted with genes from plants, animals ,bacteria or viruses that confer advantages such as drought, disease and pest resistances (good)	-Looking to enhance food security of its citizens (good)	-Government has put into place Biotechnology policies to regulate the import and propagation of such GM crops to ensure health and environmental safety (good)	- Good
G	GM food (good)	GM foods have been inserted with genes from plants, animals ,bacteria or viruses that confer advantages such as drought, disease and pest resistances (good)	-The government wanting to enhance the food security of its citizens (good)	-In case of emergency the Biosafety policies are overlooked (bad)	-Bad (vitiates moral goodness). In cases where the GM food is clearly not fit for human consumption (i.e. moral object is bad), then the moral value becomes bad.

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Scenario	Physical object	Moral object	Intention	Circumstances	Overall moral value of action
H	GM food produced not fit for human consumption and has clear negative effects(bad)	GM food produced not fit for human consumption and has clear negative effects (bad)	Can be good or bad	Can be good or bad	-Moral value becomes bad because the object, in relation to human consumption, cannot/should not be used.

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Table 1 illustrates how varied intentions and circumstances may affect the overall morality of GM foods. For purposes of discussion, possible situations have been given that could arise when GM foods are produced

In scenario A in table 1, the moral object is the GM foods containing genes that confer certain advantages to the crops such as drought, pest and disease resistant. The moral value of this object is good since GM foods containing these genes will result in more improved crops and therefore enhance food security, which consequently contributes to bodily well being of people and their common good. The intention of scientists who insert the genes may be to provide enhanced crops able to withstand harsh environments thus helping to ensure food security. From a moral point of view this can be considered as good since it will also contribute to people's bodily well being and the common good. The circumstance surrounding this action can be said to be that some of these genes might be harmful especially if they come from non plants such as bacteria and viruses. Morally, due to negative circumstances. such genes could be harmful to humans who consume these plants or to the environment where they are grown. In this scenario, it is possible to say that the overall moral value of having GM foods is bad. According to Aristotelian ethics, if the circumstances are bad, they modify the object, which in this case is good and therefore make the moral acceptability of GM foods in this situation bad.

In scenario B, the moral object is the GM foods containing genes that confer certain advantages to the crops such as drought, pest and disease resistant. The moral value of this object is good since GM foods containing these genes will result in more improved crops and therefore enhance food security by contributing to the bodily well being of people and their common good. The intention of biotechnological corporations in coming up with GM seed would be to maximize profits by being monopolies in that field. Maximization of profits cannot be considered a bad intention, but can become bad if profit maximization is given a higher priority over human health. The circumstances would be an increase in farmers' dependence on these biotechnology corporations for seed. This would be morally bad since there is a lack of freedom to choose between their own seed and GM seed. In this scenario, it is possible to say that the overall moral value of having GM foods is bad. According to Aristotelian ethics, if the circumstances are bad, it modifies the object, which in this case is good and therefore make the moral acceptability of GM foods in this situation bad.

In scenario C, the moral object is GM foods containing genes that confer certain advantages to the crops such as drought, pest and disease resistant. The moral value of this object is good since GM foods containing these genes will result in more improved crops and therefore enhance food security thus contributing to the bodily well being of people and their common good. The intention of biotechnological corporations could be seen as selling seeds with terminator technologies. This can be termed to be morally bad since these terminator technologies will affect the availability of seed in successive seasons. The corporation does not consider the common good, but instead, focuses on creating a monopoly. The circumstances surrounding the action is that such seed containing terminator genes could result in the farmers loosing the original genetic diversity of their crops. This can be evaluated as morally bad because not safeguarding the crops' genetic diversity may mean that future generations will not have access to traditional plants and may be forced to plant GM seed. This could further result in ecological disasters in the sense that the genetic diversity of GM plants may not be as wide as traditional ones. Therefore in the case of natural disasters, the whole genetic diversity can be lost because of similarity in genes. In this scenario, it is possible to say that the overall moral value of having GM foods is bad. According to Aristotelian ethics, if both the intention and the circumstances are bad, it modifies the object, which in this case is good and therefore make the moral acceptability of GM foods in this situation bad.

In scenario D, the moral object is the GM foods containing genes that confer certain advantages to the crops such as drought, pest and disease resistance. The moral value of this object is good since GM foods containing these genes will result in more improved crops and therefore enhance food security thus contributing to the bodily well being of people and their common good. The farmers 'intention would be to enhance food security by ensuring that crops are improved for nutrients, pest and herbicide resistance. The intention can termed in moral terms as good since it is concerned with ensuring food security and hence contributes to the common good. The circumstance surrounding this action is that the GM crops may affect human health and the environment. In this scenario, the overall moral value of having GM foods is less good. According to Aristotelian ethics, and using the same basis as the aforementioned scenario the moral acceptability of GM foods in this situation bad.

In scenario E, the moral object is the GM foods containing genes that confer certain advantages to the crops such as drought, pest and disease resistance. The moral value of this object is good since GM foods containing these genes will result in more improved crops and therefore enhance food security thus contributing to the bodily well being of people and their common good. The consumers' intention is need for quality and better tasting food. The moral value of the intention is good since it contribute to the physical well being of the people and therefore their happiness. The circumstances which might surround such an action is that consumers fear allergic and antibiotic resistance after consuming these crops. These circumstances, if they do happen, can be termed as bad since anything that would harm the human person since it goes against the nature of the human person and doesn't help to conserve the bodily health. In this scenario, the overall moral value of having GM foods is less good. According to Aristotelian ethics, and using the previous scenarios and maxims, if the circumstances are bad, it modifies the object, which in this case is good and therefore make the moral acceptability of GM foods in this situation bad.

In scenario F, the moral object is the GM foods containing genes that confer certain advantages to the crops such as drought, pest and disease resistance. The moral value of this object is good since GM foods containing these genes will result in more improved crops and therefore enhance food security and contribute to bodily well being of people and their common good. The intention is that the government wants to enhance food security of its citizens. The intention is morally good since government is concerned for its citizens. The circumstances surrounding the act are that the government is trying to put into place biotechnology policies e.g. the Kenya Biosafety Act (2009), to regulate the importation and propagation of GM crops to ensure health and environmental safety. These circumstances can be termed as morally good since they are concerned with ensuring the well being of the human person. In this scenario, the overall moral value of having GM foods is good. According to Aristotelian ethics, the ideal situation to aim for is when the object, intention and circumstances of the act are all morally good.

In scenario F, the moral object is the GM foods containing genes that confer certain advantages to the crops such as drought, pest and disease resistance. The moral value of this object is good since GM foods containing these genes will result in more improved crops and therefore enhance food security thus contributing to the bodily well being of people and their common good. The intention is that of the government wanting to enhance the food security of its citizens. The

circumstances that could surround this act are that the government may overlook these biosafety policies during a food emergency. Morally this is bad since it will mean that there exists a danger that GM food unfit for human consumption is imported into a country. In this scenario, the overall moral value of having GM foods is bad.

Conclusion and recommendations

The conclusion from the analysis is that what actually determines the moral acceptability of GM foods is the moral object, intention of the acting subject and the circumstances that surround the object (GM food). Such analysis may be beneficial to Government agencies, non-governmental organizations and other stakeholders when trying to evaluate the moral basis of their actions. It is very important that the human aspect in GM foods be taken into consideration because it is the human person who adds to any aspect the ethical or moral dimension. This will ensure that genetic engineering is always used in a way to enhance the dignity of the human person by helping him to live according to his rational nature.

Kenya, being one of few countries in Africa to develop a Biosafety Act needs to ensure that producers, consumers and other stakeholders are educated on the ethical/moral dimension of GM products. Universities can be at the forefront of imparting this information. Government plays a critical role in ensuring and promoting common good through the creation, distribution and use of GM foods. Government can ensure a regulatory and policy environment is created which encourages healthy consumption of such foods. In addition, Government should ensure that food safety measures of GM foods require that toxicity, nutritional and allergenicity tests are carried out on a case by case basis before it is approved for marketing (Artemis Dona & Ioannis S. Arvanitoyannis, 2009)

The Government should establish reactionary mechanisms to be followed in case of emergencies like drought and crop failure. If it is to import food, it should ensure that GM food has passed safety and environmental standards in the country of origin. In addition, consumers need to be informed about the type or range of products, especially if the food being sold in markets is GM food. Consumers need to be given the power to select between GM and non-GM food. The

language used to transmit such information should be easy to understand for the common 'mwananchi'.

Farmers can be encouraged to grow drought resistant crops that provide food in drought situations e.g. cassava and sweetpotato. Farmers should be educated to stop over relying on one crop and informed about other options.

Health and environmental concerns that people raise about GM foods so far have been speculative. As yet, no scientific evidence has been given for the harmful effects on humans though studies do exist which show negative effects of GM food on other animals. Universities like Strathmore, which is focused on humanities should team up with other research institutes engaged in the production of such products and therefore ensure that the products are not only economically and technologically sound, but also morally. Many years of careful, independent research with animals and clinical trials will be needed in order to accomplish this assessment. Other factors which could improve agricultural production should be looked into such as traditional crop breeding, provision of farminputs, access to markets so as to ensure food security of traditional crops. This is because adopting GM foods may take a long time since the necessary toxicicity, allergenicity as well as environmental risk assessments must be carried out and need substantial investments.

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Dr. V. Gichuru

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