

ABSTRACT

This study is an ethical evaluation of Zambia's position on genetically modified (GM) maize which was exported to Zambia by the United States of America (USA) through the World Food Programme as food aid. This followed food shortages after the country experienced partial droughts in 2001/2002 agriculture season, which led to widespread crop failure. After consultations with relevant groups, the Zambian government decided against the use of GM maize because of the potential harm to humans and the environment that was associated with it that called for caution in dealing with the issue. Proponents of GM maize argued that GM maize would have been an immediate solution to save people from starvation due to food shortages and that GM maize seed, if planted, would increase maize yields and subsequently food security. The opponents of GM maize argued, however, that such maize had potential harmful effects for the health of human beings and the environment and therefore supported government's decision to reject the GM maize.

The study applied five ethical approaches in evaluating the decision of the government, namely, the common good, the right to safe food, the dignity of human life, the autonomy of every nation, and the justice/fairness approach. Informed consent and the precautionary principle were also applied. The objective of the study was therefore to review the debate regarding government's position on GM maize that was donated to Zambia by the US government through the World Food Programme to supplement food shortages experienced by communities and households affected by droughts following a drought period of the 2001/2002 agriculture season that had affected their crop yields and resulted in hunger and vulnerability. The methodology involved qualitative methods with an ethical component. Primary data was collected through formal and informal interviews with members of staff and students from major institutions of learning, research institutions, government departments and some civil society organisations. Secondary data was collected through relevant literature from books and the print media. While arguments in favour of GM maize need to be given due consideration, the arguments against were found to carry greater weight. The major findings of the study include the fact that the USA government did not seek Zambia's permission before exporting the GM maize to Zambia, that GM maize would carry undue risks to human health and the environment, and that alternative approaches were available. The ethical evaluation concluded that the government was justified in banning GM maize. It was recommended that proven conventional plant breeding methods to develop varieties of crops with resistance/tolerance to biotic and abiotic stresses should be promoted. Despite that Zambia is not practising biotechnology in its plant breeding programmes, there are proven conventional plant breeding approaches that have and continue to be applied to develop high yielding varieties of food crops with tolerance to biotic and abiotic stresses which are contributing to the country's food security. These, coupled with sustainable agriculture practices, can improve yields to ensure food availability and food security.

DEDICATION

To my husband Valentine, for patience, understanding.

To my daughter, Linda, for her consistency and encouragement.

To my four boys: Chomba, Mulenga, Consolato and Mwila, to pursue education and to love knowledge.

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CHAPTER 1

INTRODUCTION

1.1 Background

In the European Union, the term “genetically modified organism” (GMO) is legally defined as follows: ‘an organism is “genetically modified” if its genetic material has been changed in a way that does not occur under natural conditions through cross-breeding or natural recombination’. Genetic modification is, therefore, a process in which foreign genes, transferred from one or more organisms, are introduced into another living organism. The introduced genes are called transgenes and are presumed to possess ecological, nutritional or other characteristics. The living organism that receives these new genes is called a genetically modified or transgenic organism (Secretariat of the Convention on Biological Diversity, 2000: 14 - Cartagena Protocol)¹.

Genetically modified crops are divided into different categories. Some are input related in which case plants are modified to be resistant to weed killers and pesticides. Others are storage related, modified to keep long under storage to reduce storage costs as, for example, the slow ripening and softening of tomatoes which is beneficial to manufacturers (Hickey and Mittal, 2003: 13).

Genetically modified foods are found on world markets and in supermarkets of the world. This has drawn angry reactions from civil society all over the world that feel that their rights to safe food and sustainable livelihoods may be violated (Butler and Hallows, 2002: 1).

Proponents of GM food argued for GM food aid acceptance for a number of reasons. For instance, that maize is said to be digestible and has very insignificant side effects (Mukula, 2002a: 3). Furthermore, it was noted that the GM foods were thoroughly

¹ See appendix 1

evaluated by independent assessors to ensure that they were safe for human consumption (Shonga, 2002: 9). It was further argued that GM food was to feed people only during the period of the food crisis (ibid.). In fact, America was said to be ready to share data on GMOs (Mupuchi, 2002b).

Further arguments in support of GM food were that the question of cross breeding with the traditional crops does not arise because Zambia does not have original maize varieties. Furthermore, it was argued that crossbreeding has been there since time immemorial; it is only the mode that has changed with the advent of genetic modification. Farmers have created new varieties of fruits and vegetables by cross breeding plants with desired traits. The difference today is that genetic engineering vastly speeds up the process and gives scientists advanced precision (Shonga, 2002: 9). In addition, in famine situations, people cannot reserve some grains to be planted in future because they consume everything (ibid.).

Further arguments were against letting people starve to death. For instance, it was contended that GM maize was safe to eat: “Posterity will judge this generation harshly if today we let 2.3 million people die of starvation unnecessarily and then, 30 years down the line, it is confirmed that GM maize is just okay after all” (ibid.). It was further added that the risks posed by GMOs could be managed through milling at the point of entry. Zambian scientists could be availed the bio-data and the type of bioengineering which has been carried out including food safety tests in the country of origin before delivering to the recipient country (ibid.).

Others used the argument of choosing the lesser evil by suggesting that allergic reactions are a lesser evil than losing lives due to starvation. This means that allergic reactions resulting from GM food consumption could possibly be treated, unlike lost lives. For instance, according to Zambia Consumers Association (ZACA) Executive Secretary,

Muyunda Ililonga, “it is better to risk an allergic reaction than risk starvation. Acceptance of GM maize in this instance is purely for the purpose of averting human catastrophe” (Mulido, 2002: 9). Senior Chief Chitambo of the Bisa people in Serenje who was urging the government of Zambia to accept GM maize said: “This is manna from heaven that has come at the right time to save people from starving” (ibid.). He further suggested that the government of Zambia insisted on having the maize ground into mealie meal before it is accepted so that it cannot be planted and contaminate indigenous species (Chimba, 2002: 1).

Others again argued in favour of GM maize on the basis that other countries such as the USA had been consuming a lot of GM foods and that they never experienced any side-effects. For instance, the then UPND spokesperson, Patrick Chisanga, did not see any reason why government was reluctant to accept GM maize because it was not toxic: “I do not believe that GM maize is toxic. I have travelled to the US and Europe with most of my colleagues and have consumed the GM foods while there but we have not died” (Mukula, 2002b: 5). US congress member, Eare Hilliard stated that the food that was coming to Zambia was the same food that Americans ate and that Americans had been eating the crop for the past eight years because the scientific community had certified GM food as safe for human consumption (Hilliard, 2002: 1). The USA government, which is the biggest contributor of relief food to the world’s biggest food agency (WFP), had already stated a week before that it could not guarantee that its food aid would not be genetically modified (Mukula, 2002: 5).

Finally, lack of the right information is another factor cited in the debate to have contributed to the controversy. According to Sichone (2002: 6), lack of information had brought about controversies surrounding GM maize whereas people had a right to information. The lack of interaction between the media and the scientist is what had led to

the controversy over GM maize. Direct links were therefore needed between the scientists and the media so that the media could access truthful information to avoid misleading the people (Richard, 2004: 1).

According to Moses Zulu, a University of Zambia fifth year student in the School of Agricultural Sciences, he observed that Zambia had misunderstood the whole issue about GMOs because there could be good and bad GMOs. It would be better to identify the benefits that you want to get from GMOs. Some genes could be good like those for drought tolerant or pest resistant characteristics. GMOs with drought tolerant characteristics could be used to improve crop production in valleys (Personal communication, 20 April, 2010).

More benefits of GMO foods are cited, among them increased production to benefit the increasing population. This is of benefit not only to farmers but to societies at large. Increased crop yields are obtained by creating plants better resistant to weeds, pest and other diseases, e.g., corn is a very important staple food crop for many Zambians and is a widely grown grain in Zambia though vulnerable to many pests and diseases, and requires a lot of nutrients. Bigger yields can create more efficient use of land, less uses of herbicides and other pesticides.² Finally, it is said that GM maize can create a sustainable way to feed the ever rapidly growing population (ibid.).

The relatively sudden and significant growth of GM crops around the world has raised various social, economic and environmental concerns. People in developed and developing countries are concerned about GM crops' potential harm to human health and the environment. In addition, many fear that large agribusiness corporations will gain even greater financial control over agriculture and limit the opportunities of small-scale farmers (Martin-Schramm and Shivers, 2003: 291).

² Available at (<http://classes.soe.ucsc.edu/cmpe080e/Spring05/projects/gmo/benefits.htm>) [Accessed: 20 September, 2011].

By 2002, there were 53 million hectares of genetically modified crops grown worldwide. The adoption of genetic modification is said to have surpassed any other agricultural technological industry before it. Billions of dollars have been invested in transgenic organisms belonging to both the fauna and flora worlds. These include crops and animals found on world markets and in supermarkets of the world for consumption by both humans and domestic animals. This practice has drawn opposition from sectors of civil society on ethical grounds such as violation of people's rights to safe food and secure and sustainable livelihoods. In our modern globalised world, Zambia is not immune to these trends, including genetic modification (GM).

Zambia is a land-locked country lying in the southern part of Africa. It received independence in 1964 from British colonial rule. In its forty six years of existence as an independent country, Zambia's economy has been largely dependent on copper exports. However, this reliance on copper is problematic as the price of copper on the international market tends to fall from time to time, resulting in the closure of some mining companies. As a result, the government and other stakeholders have been promoting agriculture as the mainstay of the country's economy.

Zambia has a land area of 752, 000 km², 45 percent being arable land. Although only 16 percent is used for agriculture purposes, the country has immense potential for agricultural production of both crops and animals. This is seen as essential to earning foreign exchange for the country and improving the country's food security. At the time of independence in 1964, Zambia inherited a good economy and the population was less than three million people. A major part of the Zambian population lived in rural areas and depended on subsistence agriculture for their livelihoods. Major crops grown in Zambia are maize, sunflower, soybeans, sorghum, beans, groundnuts, rice, pearl millet, sweet potato and cassava (FAO, 2008: 24).

Maize is the main staple food crop eaten by almost all Zambians. There are also crops grown solely as cash crops such as cotton, tobacco, soybeans, sunflower and sugar cane. Based on the number of released crop improved varieties, maize has the highest diversity of modern varieties (ibid.).

Zambia has been experiencing adverse climatic conditions in the form of partial droughts and flooding. The droughts of 2001 and 2002 were very severe and affected many parts of the country, according to the Disaster Management and Mitigation Unity report of 2003. The report indicates that many communities and families, especially in southern Zambia, lost their crops and cattle, due to lack of water and outbreak of diseases. There were mass shortages of food throughout the country. People that were affected by food shortages suffered from hunger and had to depend on government to source and provide them with food. This forced the Zambian government to declare the food shortages a national disaster and hence the government asked the international community for humanitarian assistance to supplement its food stocks. In response, the World Food Programme (WFP) in May 2002 offered Zambia relief food in the form of maize grain which was genetically modified. However, the then President of the Republic of Zambia, Mr. Levy Patrick Mwanawasa, on the strength of professional advice, rejected the offer. The President said that the implications of modern biotechnology products, such as that of genetic engineering on human beings and animal health as well as on the environment, are not yet fully understood. He said the Zambian Government would rather be cautious and not venture into the unknown by accepting genetically modified maize. Meanwhile, the President declared the food shortages a disaster in May 2002 when he disclosed that up to four million people in Zambia faced starvation. In July, the President assured Zambians that the country would not accept GM maize until it had determined its safety for human consumption. In August 2002, the government officially rejected GM maize offered by the

World Food Programme (Moonze, 2002a: 1). In the meantime, the government endeavoured to source non-GM maize because it did not want to risk the lives of Zambians. This refusal of GM food in the midst of food shortages was not well received by pro-GM lobby groups. “Better dead than GM fed” was the response by the Economist magazine (Moonze, 2002b). Tony Hall, U.S ambassador to the United Nations Food agencies, termed the action “a crime against humanity” and said he would hold Zambia accountable if people died from starvation by applying the precautionary principle (Hickey and Mittal, 2003: 1).

One of the Institutions in Zambia that spoke strongly against genetically modified maize was the Kasisi Agriculture Training Centre (KATC) driven by the Social Teaching of the Catholic Church which emphasizes protection of basic human rights, upholding human dignity and option for the poor. It considered very carefully the effects that GM maize would have on the small scale farmers who produce 80 percent of Zambia’s food. KATC has been promoting organic agriculture in Zambia for some time now. It’s main standpoint and advice to government not to accept GM maize was that GM crops would destroy the organic agriculture system which was being promoted as a strategy to make Zambia food secure. It also pointed out that once GM crops are planted; some of them have adverse effects on the environment by killing living organisms in the soil as *Bt* crops do while decaying (Lesseps and Henriot, 2002: 12).

1.2 Statement of the Problem

The introduction of a new technology such as agriculture biotechnology and or its products may depend on the perceived balance between the benefits of the technology and the potential risks to the environment and human health. This study seeks to evaluate the ethical dimension of the GM maize debate.

The food shortages that followed the partial droughts that the country experienced in 2001 which led to widespread crop failure and subsequent hunger resulted in the USA offering GM maize to Zambia delivered through the World Food Programme (WFP). After consultation with relevant groups, the Zambian government decided against the use of GM Maize because of the potential harm that was associated with the GM maize that called for caution in dealing with the issue.

Although the proponents of GM maize argued that GM maize would have been an immediate solution to save people from food shortages and that GM maize seed, if planted, would increase maize production and food security, the opponents of GM maize argued that such maize had potential harmful effects for the health of human beings and the environment. There were strong reactions and general discontent among sectors of civil society in Zambia that felt that the introduction of genetically modified maize into the country would adversely affect food production, food safety and future livelihoods of the people. There was also the fear that GM maize grains, although meant for direct food consumption, may be planted by farmers and hence pass on their characteristics to the local maize and general environment thereby disturbing the genetic makeup of the local maize varieties. It was also feared that allowing GM maize into the country would mean that people would be fed food they would otherwise not eat under normal circumstances. These are genuine ethical concerns. But it was apparent that Zambians did not have sufficient information and knowledge about the effects of GM maize in order for them to make informed decisions. Zambia had not done adequate research into GM maize in order to adequately inform its citizenry. Although the issue of GM maize was debated at length, there was not enough practical evidence by which the government could have established the advantages and disadvantages of GM crops, particularly maize. There was therefore need for more information on GM foods as other options needed to be explored and

perhaps implemented. It was also important to bridge the information gap between the decision makers and the public so that there would be a common understanding of the issue under debate. Otherwise there was the danger that the decision to ban GM maize in Zambia may have been made in a manner that was not ethically informed.

This study, then, deals with ethical issues in the use of GM products by applying the following principles and theories: informed consent and the precautionary principle, the common good, the right to safe food, the dignity of life, the autonomy of every nation, and justice.

1.3 Objectives of the study

There are three objectives of the study:

- a) to review the Zambian debate for and against genetically modified maize;
- b) to identify the ethical concerns about genetically modified maize; and
- c) To make an ethical evaluation of the Zambian government's position on genetically modified maize.

1.4 The research questions

There are then three related research questions:

- a) What are the reasons for and against genetically modified maize in Zambia?
- b) What ethical concerns have been raised during the debates about GM maize in Zambia?
- c) What ethical evaluation can be made of the Zambian government's position on genetically modified maize?

1.5 The Significance of the Study

This study endeavours to highlight ethical points of view regarding GM crop production, especially maize, in relation to its effects on human welfare, the environment and the Zambian farmers' seed banks. Such knowledge will help consumers to make informed decisions in choosing what to consume. It will also be useful to inform farmers in choosing the variety of crops and seeds to be planted as well as measures to be taken when handling such products. Finally, it is hoped that this dissertation will be a reference document for future research.

1.6 Methodology

The research methodology was qualitative along with an ethical evaluation of the data. The methods used involved both primary and secondary data. Primary data was collected through formal and informal interviews with three lecturers and one fifth year student from the School of Agriculture at the University of Zambia, one member of staff of the National Institute for Scientific and Industrial Research, staff from the Zambia Agricultural Research Institute, three officials from the Ministry of Science, Technology and Vocational Training, personnel from the Ministry of Agriculture and Cooperatives and other government officials. Others interviewed were staff and farmers of Kasisi Agriculture Training Centre, two staff members of the Jesuit Centre for Theological Reflection (JCTR), members of the Organic Processors Association of Zambia, NGOs involved in advocacy, members of the Biotechnology Association of Zambia and the National Farmers Union. Individual informal discussions were also held with some members of the general public.

The total sample was twenty. Purposive sampling technique was used. Secondary data was collected through documentary review conducted by reading articles, reports,

books and other literature on debates on genetically modified maize. The theoretical framework involved five different ethical perspectives that were applied in decision making, namely, the common good approach, the rights approach, the dignity of human life, the fairness/justice approach and the autonomy of a nation.

1.7 Delimitations of the Study

The study was about the ethical issues surrounding the debate on Zambia's position on the introduction of genetically modified maize into the country. The study therefore limited itself to the issue of the GM maize that was donated to Zambia by the US government to mitigate the food shortages following the drought of 2001/2002. It also limited itself to GM maize used for human consumption.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A review in this chapter is made of the literature on the food crisis and the debate on GM maize in Zambia. In a democratic state, it is important for the government to promote freedom of expression on different issues that affect the lives of the people. Consequently, the Zambian government gave the opportunity to the citizenry to express its views on GM maize before a decision was taken. This chapter discusses the different points of view that were advanced by different stakeholders on GM maize. Factors that caused the food crisis in Zambia, which led to Zambia being offered GM maize, were also considered. In other words, it reviews the debate for and against acceptance of GM maize by the Zambian government in 2002. Among important documents reviewed were the Cartagena Protocol, the Zambian Biosafety Act, reports on the findings of the Zambian consulting team that travelled the globe to learn about effects of the GM maize and other documents written by concerned organisations such as KATC, JCTR and GM related documents accessed on the internet.

Since 2002, when the late President Patrick Levy Mwanawasa banned the entry into Zambia of any genetically modified maize, the issue of GMOs has remained a controversial topic. Having listened to the reasons for and against GM maize, on economic, health and environmental grounds, the president decided to abide by the Cartagena Protocol (CP) which demands caution when dealing with potentially harmful and scientifically uncertain matters. It is necessary, therefore, to present firstly the background of the food crisis in Zambia in the 2001/2002 farming season.

While drought impacts negatively on Zambian food security, the structure of the Zambian agricultural economy also plays a role. According to the World Food Summit of

1996, “food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (FAO, 2002: 23). This definition assumes that the means of increasing food availability in many countries exist, but are not being realized because of a range of constraints. In Zambia, for instance, considerable agricultural potential is not fully realized, considering that out of 752,000km², 45 percent is arable land, but only 14 percent, amounting to 9 million hectares, is under cultivation (ibid.). Although agriculture provides a livelihood for over 67 percent of the economically active population, it accounts for only 18-20 percent of the gross domestic product. It is the main source of income and employment for rural women, who constitute 65 percent of the total rural population (Craig, 2001: 22). About 600,000 farm households cultivate for subsistence, working farms of an average size of 2 hectares with hand-hoes or oxen (ibid.). Another 119,000 are emergent commercial farmers, producing both for subsistence and the market. There are 25,250 medium-scale commercial farmers on land sized between 20-60 hectares in area, with over 740 large-scale farmers or farm corporations on land over 60 hectares in area. Zambia’s main food crops are maize, sorghum, cassava and millet, while other cash crops include sunflower, groundnut, wheat, cotton, soya, sugar and tobacco. Small maize surpluses are occasionally exported (Moyo *et al.*, 1993: 273).

Increasingly, non-traditional agricultural exports have become important. Zambia has been able to export vegetables such as green beans, baby corn, eggplants, carrots, chillies and peas. Cut flowers have also provided profitable income in export markets. Revenue from these products rose from US\$46.5 million in 1995 to US\$133.9 million in the year 1999. These exports are likely to be affected adversely by higher prices of inputs such as energy and fertilizer (Bohannon, 2002: 45).

Since colonial times (1889-1964), land has been divided into three categories: State, Reserve and Trust lands. Reserves of agriculture land fall under customary law and are only available to indigenous Zambians. State land is used for commercial agriculture as well as for township and infrastructural development, and is administered under a leasehold system promoting private tenure and commercial production. Trust land is reserved for the common benefit and includes protected wildlife areas and state forests. Traditional authorities exercise control over the reserve lands. That means that they are the ones who allocate land to individuals and communities. Individual title in reserve land is rare and, even if given, the costs of surveying tend to be prohibitively high, beyond the ability of people with low income. Communal land ownership leaves little individual responsibility for conservation of the fertility of the land. Mobility within the reserves has diminished owing to rapid increases in population density. Farmers resort often to the slash and burn system, leaving the land prone to erosion and soil degradation. Invasion of state land is often linked to ancestral claims that have become more frequent. Private leases of limited state land have led to speculation, high prices and conflicts over land use. The inalienability of traditional land has inhibited its optimal development because it constrains individual or family investment, innovation and entrepreneurship (Moyo *et al.*, 1993: 18). It also disfavours women's tenure right, despite their massive contribution to agricultural production. These patterns have led to fluctuations in crop production since 1990, especially maize which is a staple food for many Zambians. The land tenure system which involves the legal right to occupy land is just one problem among others inhibiting growth in food and cash-crop production. Others include the lack of agriculture extension support, inadequate transport, environmentally unsustainable practices, and high cost quality seeds, lack of access to credit, technology and cheap energy (*ibid.*: 202).

The Zambian government, working towards making agriculture a prime export earning sector and having a major role in poverty reduction, is promoting investment in irrigation and rain-fed agriculture production and encouraging public and private participation, especially in input supply and crop marketing. The Structural Adjustment Programme, initiated by the World Bank and IMF in the 1990s, severely limited public participation in the agricultural sector. Subsidies came to an end, as did government procurement of seed and fertilizer. Small scale farmers were adversely affected, and food production fell (Lewanika, 2003: 1).

2.2 The Drought in Zambia (2001/2002)

Southern Africa has been experiencing variable climate and rainfall patterns over the past three hundred years. This is often in the form of alternating wet and dry spells. Droughts in the region are therefore endemic and recurrent (Moyo *et al.*, 1993: 203). Drought is defined as a long period of abnormally low rainfall, especially one that adversely affects growing or living conditions, or periods of abnormally dry weather which lead to hydrological imbalances, or a prolonged period of abnormally low precipitation and a shortage of water resulting from this (Free Online Dictionary). It is a condition of moisture deficit sufficient to have an adverse effect on vegetation, animals, and people over a sizeable area (Warwick, 1975). These can lead to changes in the volume or frequency of rainfall, or alterations in the atmosphere's evaporative demand. Such alterations may affect the survival of crops, livestock, forests, other vegetation, wildlife and human beings.

Meteorological drought is one type of drought which has been defined as "a period of abnormally dry weather, a sufficiently prolonged period of lack of water to cause serious hydrologic imbalance in the affected area" (Hutchie, 1959). Another type

of drought is an agricultural drought which is a climatic excursion involving a shortage of precipitation sufficient to adversely affect crop production or range production. Ecological systems thus become severely stressed, and economies face conditions of food insecurity, inflation, job loss and increased prices (Rosenberg, 1979). Yet another type is hydrologic drought which refers to "a period of below average water content in streams, reservoirs, groundwater aquifers, lakes and soils" (Yevjevich *et al.*, 1977). Simply put, drought is dryness due to lack of rain. An absolute drought is a period of at least 15 consecutive days to none of which is credited 0.01 inches of rain or more. A partial drought is a period of at least 29 consecutive days, the mean daily rainfall of which does not exceed 0.01 inches. A dry spell is a period of at least 15 consecutive days to none of which is credited 0.04 inches or more (*ibid.*).

The effects of dry weather on agriculture production are largely borne by the rural poor, but food price inflation also affects the urban poor. In the Southern African region, droughts have been recorded in the following years: 1946/7, 1965/6, 1972/3, 1982/3, 1986/8, 1991/2, 1994/5 and 2001/2. In some parts of the region, the droughts in 2002 were the most severe. Their severity has partly been attributed to the El Niño-Southern Oscillation (ENSO) phenomenon. During an ENSO phase, triggered by an upwelling of warm water in the equatorial Pacific Ocean, normal airflow from the Pacific to the Indian Ocean is weakened, leading to high rainfall across South America and low rainfall over southern Africa (Chenje *et al.*, 1996: 33).

The impact of anthropogenic climate change is thought to be increasing the intensity of droughts, raising temperature levels. Southern Africa is not generally a major carbon emitter (with the exception of the most industrialized and coal-reliant South Africa which contributes between one to two percent of global greenhouse gas emissions). Nevertheless, the burning of biomass, especially charcoal, adds to the problem (*ibid.*).

The drought of 2001/2 was said to have impacted 2.4 million people in Zambia. Food deficits were largely experienced in drought hit communities in the country. Recurrent floods added to the challenges faced by the country regarding food availability. While questions of disaster management were being addressed more rigorously, the country was not able to develop infrastructural strengths in food delivery to enable more stakeholders assist in food distribution (Mulenga, 2002: 5). As neo-liberalism spread in the region, macro-economic policies tended to leave food pricing and distribution to the market. This situation affected the safety-net for the poorest who became more vulnerable to hunger. The state sector shrunk, losing the capacity to guarantee that social services were undertaken in the interests of the poor (ibid.).

While droughts had their origin in climate change, some of the other factors influenced their extent and duration. These included the following at national level: questions of preparedness, logistical infrastructure, sustainable land allocation and use, the extent of social solidarity, the nature of the country's macro-economic policies, its degree of commitment to food security, and the population's health status. External factors included the level of international commitment to reduce global warming, the development of aid policies of donor governments, and the distribution strategy of relief agencies (Moyo, 1993: 23).

2.3 The food crisis in Zambia

Zambia recorded a maize deficit during the 2001/2002 production season affecting consumption patterns of 2002/3. This was due to drought as well as to other factors that have been mentioned in the preceding section. The crisis was severe in the Southern, Central and North Western provinces where a total of 2.4 million people were in danger of starvation. They started looking for wild food to feed on (Woods, 2002a: 5). In Siavonga,

people were eating once a week and others were feared dead because of eating wild foods including poisonous mushrooms (ibid.). In addition, Richard Reagan, the World Food Programme Officer, urged the Zambian government to take quick action as people's lives were at stake. He argued that a delay in making a final decision to accept GM maize could directly result in widespread suffering and eventual death (Chimba, 2002: 9).

2.4 Relief food: Genetically Modified (GM) maize

Assessing the severity of the situation, the World Food Programme brought some GM maize into the country in readiness for distribution to the food-deficit communities. Before the commencement of the distribution exercise, the then President of Zambia, Mr. Patrick Levy Mwanawasa, announced that the Zambian government would not accept genetically modified maize being offered by the American Government until consultations with experts were completed. He insisted that "Zambians would rather starve than accept GMO food without establishing its safety" (Hanyonga, 2002a: 6). It was not that government had rejected the maize but that it was not sure how safe the maize was for human consumption (Hanyonga, 2002b).

The establishment of the safety of the relief food was necessary (Muyuni, *et al.*, 2002). GM maize is a product of biotechnology. It offers many potential benefits as well as risks to diverse groups of people. The release of genetically modified organisms into the environment is frequently compared to the introduction of novel species into the environment. The introduction of some species, especially agricultural species such as maize and wheat, has provided enormous benefits to people. On the other hand, the cost of the introduction of species has been huge and largely unexpected. In the United States, for instance, approximately 50,000 non-indigenous plant species caused environmental damage and losses estimated at \$137 billion per year (Paoletti and Pimentel, 2000:18). For

example, in the United States, 128 species of biotech crops have become serious weeds. It should be noted that there is relatively little public concern over the impacts of introduced species which are known to be large, but there is substantial concern over the possible impacts of GM crops (Sharma, 2002: 1).

Aspects of GM crops that are relevant to the profits of farmers and agribusinesses have been well studied. However, the concerns of those who eat food are only beginning to be addressed. Regulatory agencies have not been using accepted ecologically comprehensible criteria to assess the risks associated with GM organisms (Monty, 2009a: 2). This deficiency can be explained by the political pressure that has been exerted on agencies to rapidly approve the release of genetically engineered crops (Rissler and Mellon, 1996: 38). This pressure has left agencies without the physical, institutional, and conceptual framework necessary to thoroughly evaluate the risks associated with particular crops. One possible approach is to assess the risks and benefits of specific types of GM modification for different species in different ecological contexts (Bella *et al.*, 1985: 5).

2.5 Pressures to accept GM Maize as food aid

The term 'food aid' refers to the international transactions that result in the provision of aid in the form of food commodity to a country deemed to be in need of receiving such aid (Anderson, 2002: 34). Food aid is governed by activities of bilateral development cooperation agencies, multilateral institutions and NGOs. It is used to support food assistance in countries eligible for aid. It is also used to fund general development through the balance of payment support by substituting for commercial imports or budgetary support from the revenue generated by selling food received from donor communities (Craig, 2001: 37).

As the Zambian food crisis grew, it transpired that the WFP decided to bring into Zambia food aid in the form of GM maize. They had been providing GM food aid to African countries for some years without their prior informed consent. According to Judith Lewis, WFP's Director for Eastern and Southern African countries, all the famine blighted countries had received GM maize as part of food aid (Musanau, 2002: 9). This was echoed in a statement by the head of the WFP, James Morris, that "there is no way that the WFP can provide the resources to feed these starving people without using food that has some biotech content" (Mulido, 2002: 9). At its executive board meeting in October 2002, the WFP refused to adopt a policy critical of GM food aid (ibid.).

The heaviest pressure on the Zambian Government to accept GM maize aid came from the WFP, WHO and the FAO. These organizations issued a joint statement to the effect that there was no reason for African countries not to accept GM food aid. They based their argument on the fact that GM food was consumed by millions of people globally and no adverse effect had been observed so far (ibid.: 37). The WFP insisted that it could not source non-GM food aid from the region or anywhere else and was not willing to provide resources to transport maize from surplus areas of Zambia to deficient areas. In other words, the US was not ready to finance non-US products (Mupuchi, 2002a). The WHO even went as far as to invite Ministers of Health from the Southern African region to discuss the issue of GM foods (Nkoma, 2002: 9).

Further, these organizations even threatened to take legal action against governments that rejected food aid, thereby causing potential deaths. For instance, the FAO representative, Tony Hall, told reporters that "people that deny food to their people, that are in fact starving people to death, should be held responsible for the highest crimes against humanity in the highest courts in the world" (Phiri, 2002a: 1). The US secretary of Agriculture, Anne Veneman, blamed the antibiotech forces for scaring Zambians into

believing that GM maize would harm them. She argued that “it is disgraceful that instead of helping hungry people, these individuals and organizations are embarking on an irresponsible campaign to present misinformation and create an atmosphere of fear which has led to countries in dire need of food to turn away safe wholesome food” (Saluseki, 2002: 2).

Other UN agencies were also quick to use the crisis to pronounce on the safety of GMOs. In a statement, issued on the eve of the World Summit on Sustainable Development (WSSD), FAO and WHO announced their satisfaction that the US had applied its established national food safety risk assessment procedures and fully certified that these foods were safe for human consumption (Mupuchi, 2002b). It was stated that GMOs, being provided as food aid in Southern Africa, were not likely to present a human health risk (Banda, 2002: 9). It was further argued that in Southern Africa, with no large genetic diversity of maize, out-crossing was less of a concern (ibid.). Further, at a FAO press conference, Director General, Jacques Diouf, stated that “the UN believes that in the current crisis, governments in Southern Africa must consider carefully the severe and immediate consequences of limiting the food aid available for millions so desperately in need” (FAO, 2001:18). Thus, the discourse had been restricted completely to the UN agencies most closely related to the food crisis.

In addition, the United States, through the bio-safety negotiations, was aware of Zambian government’s misgivings about GMOs. It calculated that if the Zambian government accepted GM maize under conditions of a food crisis, it would be more difficult to refuse further incursions of GM maize at a later stage (Phiri, 2002b: 3). Therefore, the USA put pressure on the Zambian Government, through statements from senior officials who adopted the discourse of “accept GM aid or starve.” For instance, at the World Summit for Sustainable Development (WSSD) in Johannesburg held in August

to September 2002, the US Secretary of State, Colin Powell, provoked heckling and booing when he stated that “in the face of a famine, several governments in Southern Africa prevented critical US food assistance from being distributed to the hungry, by rejecting biotech maize which has been eaten safely around the world since 1995” (Moonze, 2002b: 2). US trade representative, Robert Zoellick, blamed the European moratorium on GM for discouraging Africa from accepting GM imports: “It gets much more worrisome when the European anxieties and fears and paranoias prevent starving people from getting food” (ibid.). US under-Secretary of State, Alan Larson, at a press conference shortly after Zambia’s decision to reject GM food aid, warned that “hunger-stricken Zambians would perish simply because there was some misrepresentation of facts over the GM foods that had been donated. It is something that has begun to run the risk of having extraordinarily damaging consequences for some of the most vulnerable people on the face of the earth (Chola, 2002: 1).

2.6 National Debate on GM Maize Donation

The Zambian government was faced with a dilemma regarding the issue of GM food aid from the USA. Whatever decision the government was going to make, it was bound to have negative consequences in one way or another. Accepting the GM food aid would have meant accepting whatever consequences would result from the consumption of this type of food. On the other hand, rejecting the food would have meant mass starvation for the people, unless a more suitable supply of alternative food was found. Zambians cried for food instead of continued debating (Lombe, 2002).

Due to intense pressure from within and outside Zambia to accept GM maize, the Zambian government decided to seek guidance from various stakeholders by calling for a national consultation process. This was conducted in the form of meetings, interactive radio and

television programmes and newspaper articles. This consultation culminated in the national debate at the Mulungushi International Conference Centre on the 13th of August, 2002. The debate was attended by the Zambian citizenry from all walks of life. Prominent among the participants were traditional leaders, members of parliament, representatives of non-governmental organizations, scientists, university lecturers and professors, senior civil servants, representatives of the United Nations Agencies, representatives of the donor community and ordinary people (Chabala, 2002a: 9). The outcome of the debate was the decision of the Zambian government to ban the importation of GM maize.

2.7 Summary

This chapter has summarised the context of the debate on the importation of GM foods, especially maize, into Zambia. It has noted that, whereas the Zambian government banned the introduction of GM maize into the country, there were many who believed that this was the wrong decision to make.

CHAPTER 3

ETHICAL THEORETICAL FRAMEWORK

3.1. Introduction

Across the world, food is part of cultural identity and of social life, and it has religious significance for people. Thus, depending on the context, any technological alterations, including changes to the genetic basis of crops, may be met with social resistance. In Zambia, the question of GM maize raised a number of ethical issues.

3.2 Ethical Approaches

The following ethical principles/theories will be applied to make an ethical evaluation of the Zambian government's decision on genetically modified maize.

3.2.1 Informed Consent and the Precautionary Principle

Informed consent is a fundamental requirement in ethical decision making. The person or persons involved must have adequate information relating to what they are being asked to give consent to and that they must give their consent freely and not under any form of coercion. The precautionary principle holds that where there are risks of serious or irreversible damage, lack of full scientific certainty should not be used as a reason against taking measures to prevent harm.

3.2.2 The common good approach

The proponents of this approach argue that life in community is a good in itself and our actions should contribute to that life. This means that the interlocking relationships of society are the basis of ethical reasoning and that respect and compassion for all others, especially the vulnerable, are the basis for such reasoning. Further, this approach calls for attention to the common conditions that are important to the welfare of everyone,

particularly, a system of laws, effective police and fire departments, health care, a public educational system and public recreational facilities.

3.2.3 The right to safe food

Proponents of the rights approach suggest that an ethical action is the one that best protects and respects the moral rights of those affected. This approach is founded on the belief that humans have a dignity based on their human nature *per se* or on their ability to choose freely what they do with their lives. Based on this fact, every human being has a right to be treated as an end and not merely as a means to an end. The list of moral rights which includes the right to make one's own choices about what kind of life to lead, to be told the truth, not to be injured, to a degree of privacy, and so on, is widely debated. It is also often said that rights imply duties, in particular, the duty to respect others' rights (Veatch, 1977: 88).

3.2.4 The dignity of human life

The dignity of human life comes from the fact that life has unique intrinsic value. Therefore, whatever one does must be done in a way that helps to preserve life. Hence, in whatever decision has to be taken, saving human life should be the guiding principle. The consumption of safe food is related to the fulfilment of other rights such as the right to health and choice of food. These rights are indivisibly linked to the dignity of a human being (Mupuchi, 2002b). Human dignity implies that everyone has a legitimate claim to the goods and services required to live a truly human life, and not just for survival (Clay and Stokke, 1991).

3.2.5 The principle of justice/fairness

This approach is based on Aristotle's understanding of fairness. Aristotle and other Greek philosophers have argued that all equals should be treated equally. Today this idea is applied to say that ethical actions should treat all human beings equally and, if unequally, then fairly, based on some standard that is defensible. For instance, some companies and organizations pay people more, based on their harder work or the greater amount that they contribute to an organization. They say that it is fair because they consider this disparity in wages to be based on a defensible standard. However, it is still debatable whether this is influenced by an imbalance of power or a defensible standard (Hull, 1979: 24).

Environmental justice is an extension on traditional ethics and deals with the environmental impacts on human beings as well as the damage done to the environment itself. It involves two dimensions, viz., distributive justice and participatory justice (Figueroa and Mills, 2003). Distributive justice focuses upon how the burdens and benefits of environmental impacts are distributed among people with respect to their health. Participatory justice involves the opportunity for all concerned to take an active part in environmental decision-making. The wellbeing of future generations is also considered in environmental justice.

3.2.6 The autonomy of the nation approach

The autonomy of a nation is related to the autonomy of an individual in that the lawful representatives of a nation must be adequately informed and give free consent to whatever decisions they are called upon to make on behalf of the people.

3.3 Summary

This chapter has focussed on the ethical importance of informed consent and the precautionary principle, and on the following ethical principles/theories: the common good

approach, the rights approach, the dignity of human life, the fairness/justice approach and the autonomy of the nation.

CHAPTER 4

FINDINGS, DISCUSSION AND ANALYSIS

4.1 Introduction

There are two basic questions that one needs to ask when identifying an ethical issue. Firstly, one needs to know whether the decision or situation could be damaging to someone or to some group. In addition, one needs to be clear on whether the decision involves a choice between a good and bad alternative, or perhaps between two "goods" or two "bads". Secondly, one needs to know whether the issue is about more than what is legal or what is most efficient. This chapter, then, discusses and analyses the reasons for and against genetically modified maize in Zambia which is the first objective of the study. It also discusses the ethical concerns raised by the debate on GMOs. Finally, it explains the reasons given by the government for its decision to ban the use of GMOs.

4.2 Arguments for GM food aid

Proponents of GM food argued for GM food aid acceptance for a number of reasons. For instance, that maize is said to be digestible and has very insignificant side effects. "When it comes to health, over the last 12 years we haven't heard of any single death or malformation from GMOs. If you say side-effects manifesting after 30 years, how many of us will be alive that time?" (Mukula, 2002a: 3). Furthermore, it was noted that the GM foods were thoroughly evaluated by independent assessors to ensure that they were safe for human consumption. It was emphasised that government and consumers should know that all food derived from biotechnology was thoroughly evaluated by independent assessors to ensure that it was safe to eat (Shonga, 2002: 9). It was further argued that there was no intention to perpetually feed people on GM food, but that it was just for that

short period of the food crisis (ibid.). In fact, America was said to be ready to share data on GMOs (Mupuchi, 2002b).

Others have argued that the question of cross breeding with the traditional crops does not arise because Zambia does not have original maize varieties. Furthermore, it was argued that crossbreeding has been there since time immemorial; it is only the mode that has changed with the advent of genetic modification. Farmers have created new varieties of fruits and vegetables by cross breeding plants with desired traits. The difference today is that genetic engineering vastly speeds up the process and gives scientists advanced precision (Shonga, 2002: 9). In addition, in famine situations, people cannot reserve some grains to be planted in future because they consume everything (ibid.).

Further arguments were against letting people starve to death. For instance, it was contended that GM maize was safe to eat: “Posterity will judge this generation harshly if today we let 2.3 million people die of starvation unnecessarily and then, 30 years down the line, it is confirmed that GM maize is just okay after all” (ibid.). It was further added that the risks posed by GMOs could be managed through milling at the point of entry. Zambian scientists could be availed the bio-data and the type of bioengineering which has been carried out including food safety tests in the country of origin before delivering to the recipient country (ibid.).

Others used the argument of choosing the lesser evil by suggesting that allergic reactions are a lesser evil than losing lives due to starvation. This means that allergic reactions resulting from GM food consumption could possibly be treated, unlike lost lives. For instance, according to Zambia Consumers Association (ZACA) Executive Secretary, Muyunda Ililonga, “it is better to risk an allergic reaction than risk starvation. Acceptance of GM maize in this instance is purely for the purpose of averting human catastrophe” (Mulido, 2002: 9). According to Senior Chief Chitambo of the Bisa people in Serenje,

who was urging the government of Zambia to accept GM maize, “this is manna from heaven that has come at the right time to save people from starving” (ibid.). He further noted that the government of Zambia insisted on having the maize ground into mealie meal before it is accepted so that it cannot be planted and contaminate indigenous species (Chimba, 2002: 1).

Others again argued in favour of GM maize on the basis that other countries such as the USA had been consuming a lot of GM foods and that they never experienced any side-effects. For instance, the then UPND spokesperson, Patrick Chisanga, did not see any reason why government was reluctant to accept GM maize because it was not toxic: “I do not believe that GM maize is toxic. I have travelled to the US and Europe with most of my colleagues and have consumed the GM foods while there but we have not died” (Mukula, 2002b: 5). US congress member, Eare Hilliard stated that “the food that was coming to Zambia is the same food that Americans ate. Furthermore, Americans had been eating the crop for the past eight years because the scientific community had certified GM food as safe for human consumption. The scientists had not found short or long term effects from the GM food (Hilliard, 2002: 1). Therefore, he bemoaned government’s reluctance to take a decision on whether to accept GM maize or not. He argued that people’s lives were at stake and that, without urgent assistance, their situation would deteriorate into a state of famine. The USA government, which is the biggest contributor of relief food to the world’s biggest food agency (WFP), had already stated a week before by saying that it could not guarantee that its food aid would not be genetically modified (Mukula, 2002: 5). Dr. Rodger Chongwe, a Zambian prominent lawyer, also urged Government to accept GM maize instead of letting people die from starvation (Chongwe, 2002).

Finally, lack of the right information is another factor cited in the debate to have contributed to the controversy. According to Sichone (2002: 6), lack of information had

brought about controversies surrounding GM maize whereas people had a right to information. He defended GM maize by saying that it had been tested and found to be safe. “Safety checks are done before commercialising; they are very safe” (ibid.), he said, referring to the South African government which, he said, exports GM foods to the European Union. “The lack of interaction between the media and the scientist is what has led to the controversy over GM maize. Direct links are needed between the scientists and the media so that the media can access truthful information to avoid misleading the people” (Richard, 2004: 1).

Moses Zulu, a fifth year BSc. agriculture student studying at the University of Zambia Great East Road Campus, said Zambia misunderstood the whole issue about GMOs because there could be good and bad GMOs. He said that it would be better to identify the benefits that you want to get from GMOs. Some genes could be good like those for drought tolerant or pest resistant characteristics. GMOs with drought tolerant characteristics could be used to improve crop production in valleys. With trained manpower, Zambian scientists and researchers and research institutions like NISIR and the University of Zambia, in collaboration with the multinational seed companies should, he believed, work to develop varieties suitable to Zambia’s climatic conditions and situations for sustainability and follow-ups. If we were to allow foreigners to research for us, they would develop varieties that are not suitable to our conditions and this would result in a dependency syndrome (Personal communication, 20 April, 2010).

4.3 Arguments against GM food aid

Contrary to the proponents of GM food aid, opponents argued otherwise. They argued that GM food should be rejected because of the potential long term adverse effects on human life and the environment. For instance, according to Lewanika (2002: 9), GM food has the

potential to be toxic and to be a threat to human health. Therefore, government needs to take steps that will lead to the development of the national capacity to detect GMOs in food stuffs. For instance, under the Cartagena Protocol on Bio-safety, governments are required to use internationally accepted norms to decide whether to accept or reject GMOs. The protocol is a legally binding international instrument that governs the cross-border movement of GMOs. However, by 2002, both Zambia and the USA had not ratified the Cartagena Protocol. This meant that Zambia could not monitor the unintentional and illegal presence of GMOs in the donated maize in the absence of a national bio-safety framework.

In addition, cross-breeding with local varieties was another factor highlighted in the debate. For instance, Lewanika (*ibid.*) noted that once GM maize enters the country, some farmers might preserve some of it for planting, a situation which risks undermining the maize variety development programme through cross-pollination. Such a situation may endanger the biodiversity of our country. Further, he urged the government to put safety measures in place before accepting GM maize: “Before accepting, government needs to take steps that will lead to the development of national capacity to detect GMOs in food stuffs. GM foods are said to have side effects such as cancer risks, food allergies, antibiotic resistance and damage to food quality and nutrition” (*ibid.*). This point of view was also shared by Dr. Davies Lungu, a lecturer at the University of Zambia, who felt that the lack of safety regulations to inform Zambians on the safety of GM maize was a matter of concern (Personal communication, 28 April, 2010).

Further, ZNFU, through their representative, Lovemore Simwanda, wondered why the USA, which produces 70 percent conventional maize and 30 percent GM maize, decided to donate GM maize instead of the conventional one. He urged the government to reject the GM food aid for fear that the genes might escape into the environment and

disturb the ecosystem. In the *Zambian* context, traditional farming practices are such that farmers, especially small scale farmers producing for subsistence, keep their own seeds from a previous crop for planting during the following season. He said: “If GM maize was planted, there are risks that GM maize will cross with non-GM maize, thereby affecting maize production” (Mukula, 2002: 9). He also argued that the debate over GM food had focused more on the questions of health, ignoring the issue of crop production. In other words, there is need to examine what would happen to *Zambia’s* agricultural infrastructure if genetically modified crops were introduced into the country. However, he advised the government to avoid a blanket ban on GMOs, but instead to emulate Japan by keeping out only those found to have harmful effects if consumed by human beings (ibid.).

The Organic Producers and Processors of *Zambia* (OPPAZ) are also not in favour of GM maize because of the potential health and environmental risks that GM maize might pose. Their representative, Peter Manda, said that their association had zero tolerance for GM food because of its potential risks on people and the environment. They were more concerned with the long term effects than the immediate benefits (Phiri, 2002c: 6).

The director of *Kasisi* Agriculture Training Centre (KATC) at that time, Fr. Roland Lesseps, and the then director of the Jesuit Centre for Theological Reflection (JCTR), Fr. Peter Henriot, gave a joint statement to reject GM maize because it would not foster sustainable agriculture. They argued that food security required sustainable agriculture. They warned against dealing with a short term problem in ways that would bring greater long term problems. They demanded that the GM maize, which was in the country at that time, be milled outside the country with close supervision so that nothing of it was left for seed propagation. They offered an alternative by asking the government to import non-GM maize from *Kenya* and *India* (Lesseps and Henriot, 2002: 12). Dr. Pharaoh Siamanga even

cautioned against suggesting that the GM maize should be milled saying that “even that could result in negative effects on some consumers.”

Contributing to the debate, Brigadier General Godfrey Miyanda, a Zambian politician, questioned the morality of tying aid to GM maize when non-GM maize was available in the USA. He said that the Zambian government should find experts and let them debate the matter while non-GM relief maize was being sought and distributed by the Disaster Management and Mitigation Unit of the Office of the Vice President. He further argued that “it should not be food at all costs, that even wild roots are safer than GM maize” (Shonga, 2002: 9). He further stated that “it is very interesting to note that, for the first time, Zambia was being forced to accept a gift. Does this not worry us as recipients that the giver is insisting that we take GM maize? Are the Americans just concerned about our stomachs?” (ibid.). He urged the government not to allow experiments on the Zambian people where they would be used as guinea pigs adding that “you should not be pressured into doing things you are not sure about. Partners must be partners. I am not ready to risk people’s lives, even eating roots might be better than eating GM maize” (ibid.).

Furthermore, others cited trade concerns with the European Union as the basis for arguing against GM maize. For instance, according to Peter Magande, “the debate on GMOs should not be limited only to health and environmental concerns. It should include trade concerns. For instance, countries in the European Union, where Zambia exported most of its agricultural produce, have rejected GMOs and, if the country was to accept the GMOs, it would mean diminishing trade ties with the EU” (Chimba, 2002:1).

In addition, Women for Change Director, Emily Sikazwe, charged that some scientists were arguing in favour of GMOs because they were paid money to debate in that manner: “I know some scientists I met at Pamodzi Hotel last night where they plotted to

come and push this agenda” (Shonga, 2002: 9). She further argued that “it is unethical for the United States to push the GM maize on Zambians when the product was not consumed in the US” (ibid.). She considered accepting GM maize as a crime against humanity. She concluded her contribution by saying, “I am a scientist myself and I will not join a bandwagon of those that will hurry our people into accepting GM food.” During the Second World War, scientists were used to manipulate and commit crimes against humanity, she hoped that Zambian scientists would not fall prey in a similar way.

The director of JCTR insisted that GMOs were not safe because they could lead to serious national problems in the long run. According to Lubozhya (2002: 18), GMOs could bring lower yields, increase herbicide use, erratic performance and poor economic returns in the agricultural sector. They could also cause loss of European markets for Zambian products, for instance, fresh flowers, fruits and vegetables - environmental problems, pest resistance to pesticides, contamination of wild plants, greater use of chemicals, less biodiversity, harmful mutation that could cause diseases and the emergence of crops more dependent on herbicides. Overall, infrastructure of the agricultural sector could be affected (Mukula, 2002: 9).

Others again argued against GM maize in Zambia due to lack of information on the safety of the product. For instance, Lusaka Central Member of Parliament, Dipak Patel, said the debate on GM maize was just the first step towards decision making and that it was not enough to allow government to take a position, he said: “We do not have a legal framework; we have no bio-safety policy. We just do not know enough. And the question is why there are no alternatives to this GM loan? Too often we are told too late that there are no alternatives” (Moonze, 2002c). In addition, Mr Chambeshi, from the Ministry of Science and Technology, said: “It is better to err on the side of caution regarding the importation and use of GM maize” (ibid.).

The people of Zambia were assured of the government's commitment to feeding them with safe food. According to the then Secretary to the Cabinet, Leslie Mbula, "despite its concern on food insecurity in the country, the government was cautious not to feed its people with food that may turn out to be harmful" (Mukula, 2002: 9). He further said that "government was fully aware of the sufferings of the people, but wanted to feed them with food that would sustain them and future generations (Shonga, 2002: 9). In addition, the then Agricultural and Cooperatives Minister, Mundia Sikatana, said: "Government will ensure that its people are fed. If it means digging the roots which our forefathers ate, we will do that" (Phiri, 2002d). He told donors not to blame the government on the precautions it was taking on GMOs because it did not want to risk the lives of its people (Webster, 2002).

4.3.1 Shortcomings of genetically modified crops

Genetically modified (GM) crops have been celebrated by some academics, commentators and analysts as a success story for poor people in the developing world with small scale farmers able to benefit more from this technology. But a closer look at the experiences of farmers reveals a more complicated picture. It takes much more than the introduction of one or two new genes into a crop plant to transform a complex farming system (Monty, 2010: 23).

Biotechnology has made it possible to enhance the nutritional value of rice. The best known example is through "golden rice" which contains carotenoids (precursors to vitamin A) from daffodil genes (Bancroft, 2002). The golden colour is an indicator that there are higher concentrations of beta carotene in the endosperm (Tang, *et al.* 2009). To combat the widespread Vitamin A deficiency in children of developing nations, "golden rice" was genetically modified by Ingo Potrykus of Switzerland to increase the amount of the micronutrient beta-carotene (Bancroft, 2002). In nature, rice plants produce beta

carotene in the green tissue of the plant but not in the endosperm, the edible part of the seed (Mayer, 2007). The outer layer of the seed coat contains nutrients of value, the so-called aleurone layer although many of the nutrients are lost in the milling and processing procedure. Maintaining beta-carotene and vitamin A, another nutrient present in rice grain, contribute to the health and decreased incidence of blindness, disease susceptibility and premature death of undernourished children and pregnant women (Tang *et al.*, 2009). “Golden rice” would hypothetically decrease vitamin A deficiency (VAD) in children in Asia and in parts of sub-Saharan Africa. The insertion of the carotenoids into rice called golden rice has not been met with such widespread contention as have other GMOs of animal material. These genes of known vegetable origin do not raise so much debate.

4.3.2 Biotechnology does not increase yields

A major argument advanced by biotechnology proponents is that transgenic crops will significantly boost crop yields. But currently, there is no significant data to prove such claims (Rangi, 2010). Yields have not increased with transgenic crops, rather soya bean yields have remained unchanged, and maize yields are higher, only under sporadic conditions of high pest control (*ibid.*). No biotechnological breakthrough for poor farmers has been recorded, and there is no GM crop on the horizon that is expected to outperform local varieties under heterogeneous environmental conditions facing small farmers (Conway, 2000). Although data from the developing world are scarce, a US Department of Agriculture Economic Research Report (USDA, 1999), which analysed data collected in 1997 and 1998 for 12 and 18 USA regional crop combinations respectively, is very conclusive. The data collected does not prove that significant increase in yields was solely as a result of GMOs, but that various parameters of production were also involved. The crops surveyed were *Bt* corn and *Bt* cotton, and herbicide tolerant (HT) corn, cotton, and

soya beans, and their non-engineered counterparts (ibid.: 12). By 2008, it was reported that 125,000 Indian small farmers from the “suicide belt” in Maharashtra state had committed suicide (dubbed “GM genocide”) due to failure to pay back loans used to grow GM crops stemming from failure of many GM crop varieties. Widows tried to take over farming left by their late husbands and many committed suicide too. This was blamed on the ruthless drive to use India as a testing ground for GM crops (Malone, 2008: 1).

Some scientists and policy makers suggest that large investments through public-private partnership can help developing countries acquire the indigenous scientific and institutional capacity to shape biotechnology to suit the needs and circumstances of small farmers. But once again, corporate intellectual property rights to genes and gene cloning technology might play spoiler to the introduction of new technologies and can become too bureaucratic. For instance, in Brazil, the National Research Institute there must negotiate licence agreements with nine different companies before a virus-resistant papaya developed with researchers at Cornell University can be released to poor farmers. Large and medium scale farmers have advantage over small scale farmers since they can afford high cost seed and fertilisers and pest/insect control (Pratchaya, 2008: 13).

4.3.3 GMO effects on the environment

Biotechnology is being pursued in order to patch up problems (e.g. pesticide resistance, pollution, soil degradation, etc.) caused by previous agrochemical technologies promoted by the same companies now leading the bio-revolution. Transgenic crops developed for pest control closely follow the paradigm of using a single control mechanism (a pesticide) that has proven to fail over and over again with insects, pathogens and weeds (Pratchaya, 2008: 14). The touted ‘one gene, one pest’ approach will also be easily overcome by pests that are continuously adapting to new situations and evolving detoxification mechanisms. Furthermore, agricultural systems developed with transgenic crops favour monocultures

characterised by dangerous high levels of genetic homogeneity, leading to higher vulnerability of agricultural systems to biotic stresses (Robinson, 1996: 23).

As the new bioengineered seeds replace and contaminate the old traditional varieties and their wild relatives, genetic erosion of biodiversity will accelerate in the Third World (Fowler and Mooney, 1990: 22). Thus the push for uniformity will not only destroy the diversity of genetic resources, but will also disrupt the biological complexity that underlies the sustainability of indigenous farming systems (Alfieri, 1996: 34). Furthermore, the continuous use of herbicides such as bromoxynil and glyphosate (also known as “Roundup”), which herbicide resistant crops tolerate, can lead to problems (Goldberg, 1992: 23). It is documented that when a single herbicide is used repeatedly on a crop, the chances of herbicide resistance developing in weed populations greatly increases (Holt *et al.*, 1993: 14). About 216 cases of pesticide resistance have now been reported in one or more herbicide chemical families (Holt and Le Baron, 1990: 10). Triazine herbicides have about 60 most resistant weed species. The problem is that given industry pressures, increased herbicide use will expand, exacerbating the resistance problem. Although glyphosate is considered less prone to causing herbicide resistance in weeds, over time the increased use of the herbicide is bound to result in resistance (Rangi, 2010).

Companies affirm that bromoxynil and glyphosate, when properly applied, degrade rapidly in the soil, do not accumulate in ground water, have no effects on non-target organisms, and leave no residue in foods. There is, however, evidence that bromoxynil causes birth defects in laboratory animals, is toxic to fish, and may cause cancer in humans (Goldberg, 1992: 34). Because bromoxynil is absorbed dermally, and because it causes birth defects in rodents, it is potentially hazardous to farmers and farm workers. Similarly, glyphosate has been reported to be toxic to some non-target species in the soil, both to

beneficial predators such as spiders, mites and coccinellid beetles and to detritivores such as worms, as well as to aquatic organisms including fish (Paoletti and Pimentel, 1996: 45). Questions about food safety also arise as this herbicide suffers little metabolic degradation in plants and is known to accumulate in fruits and tubers, and more than 37 million pounds of this herbicide are now used annually in the USA alone. Moreover, research documents that glyphosate seems to act in a similar fashion to antibiotics by altering soil biology in a yet unknown way thus exerting effects such as reducing the ability of soya beans and clover nitrogen, rendering these plants more vulnerable to disease and reducing the growth of beneficial soil dwelling mycorrhizal fungi, which are key to helping plants extract phosphorous from soil (Costanzia *et al.*, 2000: 149).

Although there is some concern that transgenic crops themselves might become weeds, a major ecological risk is that large scale releases of transgenic crops may promote the transfer of transgenes from crops to other plants, which could then become weeds and also unleash unpredictable ecological effects (Darmancy, 1994: 38). Transgenes that confer significant biological advantages may transform wild or weedy plants into new or worse weeds (Rissler and Mellon, 1996: 18). The biological process of concern here is intro-gression (hybridisation among distinct plant species) which is a major problem in bio-diverse farming systems within centres of origin where the possibilities of transgenic variety encounter with sexually compatible wild relatives is very high. Evidence indicates that such genetic exchange among wild weeds and crops already occurs (Snow and Moran, 1997: 7).

The fact that inter-specific hybridisation and intro-gression are common to species such as sunflower, sorghum, oilseed, rape, rice, wheat and potatoes, provides a basis for expecting gene flow between transgenic crops and wild relatives to create new herbicide resistant weeds (Krimsky, 1996: 5).

4.3.4 Environmental risks of insect resistant crops (Bt crops)

According to the biotechnology industry, the promise of transgenic crops inserted with *Bt* is that they will replace synthetic insecticides now used to control insect pests. Most crops have a diversity of insect pests, and insecticides will therefore still have to be applied to control non-Lepidoptera pests which are not susceptible to the *Bt* toxin expressed by the crop (Gould, 1994: 6). But biotechnology has a limited role in pest management, even for Lepidoptera. In the USA, the economic advantage of growing transgenic corn is not assured because the population densities of the European corn borer are unpredictable. On the other hand, several Lepidoptera species have been reported to have developed resistance to *Bt* toxin in both field and laboratory tests, suggesting that major resistance problems are likely to develop in *Bt* crops which, through the continuous expression of the toxin, create a strong selection pressure (ibid.).

In order to delay the inevitable development of insects' resistance to *Bt* crops, bioengineers are preparing resistance management plans, using patchworks of transgenic and non-transgenic³ insects to delay the evolution of resistance by providing susceptible insects for mating with resistant insects. Although refuges should cover at least 30 percent of the crop area, Monsanto's new plan calls for only 20 percent refuges, even when insecticides are to be used. Moreover, the plan offers no details about whether the refuges must be planted alongside the transgenic crops, or at some distance away where studies suggest they would be less effective. But it is unrealistic to expect most small and medium sized farmers to devote up to 30-40 percent of their crop area to refuges, especially if crops in these areas are to sustain heavy pest damage. Neighbouring organic farmers growing crops without agro-chemicals would also face the risk of pest resistance to *Bt*. Once resistance appears in insect populations, organic farmers will not be able to use *Bt* in

³ Called refuges

its microbial insecticide form to control Lepidoptera pests moving in from adjacent neighbouring transgenic fields thus losing a valuable bio-rational tool for pest control (Kuyek, 2002a). Furthermore, by keeping pest populations at extremely low levels, *Bt* crops could potentially starve natural enemies, as predators and parasitic wasps that feed on pests need a small amount of prey to survive in the ecological system. Among the natural enemies that live exclusively on insects which the transgenic crops are designed to kill, egg and larva parasitoids would be most affected because they are totally dependent on live hosts for development and survival, whereas some predators could theoretically thrive on dead or dying prey (Schuller *et al.*, 1999: 8). Natural enemies could also be affected directly through inter-trophic level effects of the toxin. The potential of *Bt* toxins moving through arthropod food chains poses serious implications for natural bio-control in agricultural fields. Recent evidence shows that the *Bt* toxin can affect beneficial insect predators that feed on insect pests present on *Bt* crops (Hilbeck *et al.*, 1999: 9). Studies in Switzerland show that the mean total mortality of predacious lacewing larvae (Chrysopidae) raised on *Bt* fed prey was 62 percent compared to 37 percent when raised on *Bt* free prey. These *Bt* prey fed to Chrysopidae also exhibited prolonged development time throughout their immature stage (Braybrooke, 2003: 11).

These findings are of concern to small scale farmers, who rely for insect pest control on the rich complex of predators and parasites within their mixed cropping systems (Alfieri, 1994: 22). Inter-trophic level effects of the *Bt* toxin raise serious concerns about the potential of the disruption of natural pest control. Polyphagous predators that move within and between mixed crops cultivars will encounter *Bt* containing non-target prey outside the cropping season (*ibid.*: 5). However, disrupted bio-control mechanisms may result in increased crop losses due to pests or to the increased use of pesticides by both

large and small scale farmers, resulting in consequent health and environmental hazards (Holt *et al.*, 1996: 7).

It is also now known that windblown pollen from *Bt* crops found on natural vegetation surrounding transgenic fields can kill non-target insects. A Cornell study showed that corn pollen containing *Bt* toxin can drift several metres downwind and deposit itself on milkweed foliage with potentially deleterious effects on monarch butterfly populations (Losey *et al.*, 1999). These findings open a whole new dimension on the unexpected impacts of transgenic crops on non-target organisms which play key roles in the ecosystem, such as providing alternative food for natural enemies that depend on field margins for their existence in agro-ecosystems (Alfieri, 1998: 27). But environmental effects are not limited to the interface of crops and insects. *Bt* toxins can be incorporated into the soil through leaf materials when farmers incorporate transgenic crop residues after harvest. The fact that *Bt* retains its insecticidal properties, is protected against microbial degradation by being bound to soil particles, and persists in various soils for at least 234 days is of serious concern to farmers, especially poor farmers who cannot purchase expensive chemical fertilisers. These farmers rely instead on local residues, organic matter, and soil micro-organisms for soil fertility which can be negatively affected by the soil bound toxin (Sexena *et al.*, 1999: 12).

4.4 Viable alternatives

According to the Institute of Science in Society 2000 Open letter from World Scientists to all government delegates to the UN Commission on Sustainable Development, World Scientists have said “no” to GM maize and recommend sustainable, low input organic agricultural production as the only way to restore land degraded by conventional agronomic practices and stop hazardous GM production (Secretariat of the Convention on

Biological Diversity, 2000: 34). It is said that among the genes used in genetic modification of crops are genes resistant to antibiotics which can come into contact with pathogenic bacteria through a process known as “horizontal transfer of genes,” thereby increasing the public health problem of resistance to antibiotics. Another concern is that because transgenes can persist in the digestive tract of mammals, survive in liquid waste, in aquatic ecosystems, in the soil, and in plants, GMOs could generate allergy problems since the new proteins from genetic modification are foreign to the human immunology system (ibid.).

Additionally, due to the short-comings of biotechnology in promoting food security, the United Nations Millennium Development Goals (World Bank, 2000: 5) have set a road map for protecting the environment with a new development ethic that demands sustainability in a framework where progress is measured in terms of actions in line with the economy and ecological factors of food production to benefit both present and future generations. Based on this background, sustainable agriculture is defined as agriculture that is “environmentally sound, preserving resources and maintaining production potential, profitable for farmers and workable on a long term basis, providing good quality food and sufficiency for all people, socially acceptable and socially equitable, between different countries and within each country” (ibid.).

A secure food system is one in which the ecological resources are sustained with minimum damage to present and future generations. In other words, food security and sustainable agriculture are inter-linked and both are central to the concept of sustainable development (Bonny, 1994: 13). For people to be food secure, they must have access to the resources needed to buy or produce their own food. This requires investment in different technologies; especially those that can help boost the production of staple crops such as sorghum, cassava, maize and millet. For instance, producing nutritionally

enhanced properties in staple crops eaten by the poor could reduce the burden of disease in many developing countries.

As the production problems experienced by farmers vary between communities, technological solutions need to be relevant to those circumstances. An appropriate technology should be accessible, affordable, easy to use and maintain, effective, and most importantly, it must serve the real need (FAO, 2002: 22). A growing number of farmers, NGOs and sustainable agriculture advocates propose that developing countries should favour an agro-ecological model that emphasizes biodiversity, nutrient recycling, synergy among crops, animals, soils, and other biological components, as well as regeneration and conservation of resources, instead of the biotechnology approach that is capital and input intensive (Alfieri, 1996: 17). Agro-ecological approaches rely on indigenous farming knowledge and selected low input modern technologies to diversify production. They incorporate biological principles and local resources into the management of farming systems, thus providing for an environmentally sound and affordable way for farmers to intensify production in marginal areas (Alfieri, 2000b: 18).

There are proven ecological alternatives to biotechnology that result in technologies that are cheap, accessible, risk averting, productive in marginal environments, environment and health enhancing, and culturally and socially acceptable. A recent analysis of 208 agro-ecologically based projects and initiatives documented clear increases in food production over some 29 million hectares, with nearly 9 million households benefitting from increased food diversity and security. Sustainable agriculture practices led to 50-100 percent increases per hectare of crop production (about 1.71 tons per year per household) in rain fed areas typical of small farmers living in marginal environments. That is an area of about 3.58 million hectares cultivated by about 4.42 million farmers (Pretty *et al.*, 2000: 17). Such yield enhancements are a true breakthrough

for achieving food security among resource-poor farmers isolated from main-stream agricultural institutions. Some examples considered in this study include the following (Pretty, 1995: 12):

- Brazil: 200,000 farmers using green manures/cover crops doubled maize and wheat yields.
- Guatemala-Honduras: 45,000 farmers using the legume Mucuna as a cover for soil conservation systems tripled yields in hillsides.
- Mexico: 100,000 small organic coffee producers increased production by half.
- South East Asia: 100,000 small rice farmers involved in IPM farmer's schools substantially increased yields while eliminating pesticides.
- Kenya: 2,000 farmers using legume based agro-forestry and organic inputs doubled maize yields.

These examples are some of the many successful experiences of sustainable agriculture implemented at the local level. Data show that over time, agro-ecological systems exhibit more stable levels of total production per unit area than high input systems produce economically favourable rates of return, provide a return to labour and other inputs sufficient for a livelihood acceptable to small farmers and their families. They also ensure soil protection, conservation and enhance agro biodiversity. More importantly, these experiences, which emphasize farmer-to-farmer research and grassroots extension approaches, represent countless demonstration of talent, creativity, and scientific capability in rural communities. They point to the fact that human resource development is the cornerstone of any strategy aimed at increasing options for rural people and especially resource poor farmers.

4.4.1 Sustainable Agriculture

Sustainable agriculture takes many forms, but at its core is a reversal of the industrial approach to food production developed during the 20th century. This system, with its reliance on monoculture, mechanization, chemical pesticides and fertilizers has made food abundant and affordable. However, the ecological and social price has been high: erosion, depleted and contaminated soil and water sources, including loss of biodiversity, deforestation, labour abuses, and the decline of the family farm. The concept of sustainable agriculture embraces a wide range of techniques, including organic farming, minimum tillage, water harvesting, free-range chicken production, low-input agriculture, holistic approach to agriculture production and integrated pest management (Delaney, 2010). The common thread among these methods is an embracing of farming practices that mimic natural ecological processes. Farmers minimize tilling and water use, encourage healthy soil by planting fields with different crops year after year and by integrating croplands with livestock grazing. They avoid pesticide use by nurturing the presence of organisms that control crop-destroying pests (Rangi, 2008: 1). Beyond growing food, the philosophy of sustainability also espouses broader principles that encourage agroforestry and conservation farming that provides the farmer with a liveable income (Paul, 2006: 83).

Conservation farmers use conservation tillage methods to establish their crops but they also grow legumes in rotation with their other crops. Legumes, depending on the varieties grown, fix nitrogen, improve soil fertility, break soil pans and are an excellent source of protein for the family. Conservation farmers recognise the value of trees and live in harmony with the land rather than destroying it. Conservation farming involves adopting a number of husbandry practices that together comprise a complete farming system. According to John Mulenga, an organic farmer and member of the Organic Producers and Processors of Zambia –OPPAZ (Personal communication, 15 March 2010), if these

practices are followed correctly, farmers get a number of important benefits such as the following:

1. Farmers can plant a larger area because they are not moving or turning over the soil before they plant. This saves money and time during land preparation. For instance, conventional ploughing or ridging one hectare of land to 10 centimetres depth involves turning over or moving 1,000 tons of soil which leads to soil erosion.
2. Labour requirement for land preparation is spread over several months rather than being done at once. It is therefore more suitable for women and labour restrained households.
3. Retaining crop residues protects soil and conserves water, improves infiltration, reduces soil temperatures and, in time, improves soil fertility. Conservation farming minimizes crop loss in drought years and improves food security.
4. Planting holes or basins concentrate early rainfall around seeds, accelerating emergence and improving crop stands. Because seeds are planted in the same place each year, residual fertiliser from cereal crops can be taken up efficiently by subsequent crops. Deep rooting crops can be used in rotation to break pans by making root channels which weaker rooting crops can follow.
5. Because the inter-row is never ploughed, weed populations will decline over time as long as weeds are not allowed to seed.
6. Rotations with legumes reduce the requirement for artificial fertilisers. Pigeon peas and other legumes also have strong roots that break plough pans and aerate the soil. Pigeon peas also recycle phosphorous from deeper layers and make it available to

shallower rooted crops. Early maturing varieties of cowpea and green gram provide a high-protein source in February when food is generally scarce.

7. Hand-hoe conservation farming does not entail the need for purchasing any additional capital equipment by small holder farmers.
8. Conservation farming practices are easy to understand.

4.4.2 Improving Traditional Foods

While maize is regarded as a staple food in Zambia, Hon. Mundia Sikatana, the then Agriculture Minister, pointed out that this is not universally true for the whole country (Chimba, 2002: 9). He argued that Zambia had a long time history of using cassava as a key crop for food security, especially in the Northern and Western provinces. Although maize has become a national staple food crop and a preferred main dish for many families, it is not in origin of the Zambian soil. It originates from America but adapts quite well to the Zambian soil. The indigenous crops in Zambia are millet, cassava and sorghum (ibid.). The recognition of the value of traditional crops for achieving food security also reduces unnecessary dependence on the agro-biotechnology industry. While maize is the main crop in Zambia, its importance varies by provinces. According to reports from field visits and the Zambia Food Security Research Project, Southern, Central and Eastern provinces are primarily (80 percent or more) maize producers. Farmers in Western Province rely less on maize with increasing importance placed on cassava and sorghum production. In general, crop diversity rises with increased rainfall. Northern Province is a high producer of cassava with some sorghum and millet, while North-Western Province has become a cassava-based agricultural area in northern parts. With the increased challenges facing maize production in the face of droughts, other crops have been increasing their share in

the livelihoods of Zambians. Among these crops, the most important are the two cash crops, cotton and groundnuts, and the relatively drought resistance root crops, cassava and sweet potato (ibid.).

According to Jane Mubanga Chinkusu, the then Acting Director, Science and Technology, Ministry of Science, Technology and Vocational Training, although Zambia has not had the capacity to handle GMOs, with support from Norway, UNEP and Argentina, capacity building has started through the provision of specialist training and the provision of suitable equipment to detect GMOs in maize (Personal communication, 10 January, 2010).

According to the then Deputy Director of the Research Services of the Zambia Agricultural Research Institute (ZARI), Dr. Medson Chisi, and the Zambian government in 2002 came up with a policy to do away with GM maize. This enforcement is still in place. At that time there were neither guidelines nor regulations, only the Presidential directive to say “no”. There was no adequate technology to detect GMO presence in the maize grain. But now ZARI and NISIR have this technology. Chisi further said that research under ZARI uses conventional methods for the breeding of food crops like legumes, maize, soya beans, sunflower, sorghum, or any other crop. ZARI has GMO inspectors stationed at all borders. Pre-shipment testing is done at the originating country and, if GMOs are detected, the consignment is rejected. If the consignment is in transit to another country e.g., D.R. Congo, then the consignment is escorted by the Zambian Police, ZARI and ZRA inspectors at various points of entry. To oversee that GM crops do not get into the communities, the government has introduced bio-safety committees at ZARI and MSTVT. ZARI follows the government policy of conventional breeding which can also give qualitative and quantitative traits to the crops without leaving any known adverse effects on the environment, although this method takes long to achieve the desired results.

Zambia needs biotechnology but she does not necessarily need GMOs which are products of biotechnology (Personal communication, 10 January 2010).

Transgenic crops can also allow transgenes to escape into free living populations of land races. The invasion of transgenes into native varieties could provoke a host of negative effects such as shrinking the agricultural gene pool. Clearly any threat to local varieties represents a threat to the food security of local farmers. While there is fear that GM maize may contaminate wild relatives like in Mexico, in Zambia we fear that it can contaminate the land races which are close to “wild relatives”. There are also bad GMOs like the terminator genes that may be infecting other crops and making them extinct. There are fears that if these were planted, they may spread their pollen through cross pollination and infect other relative crops. These should be discouraged or discarded altogether. Although Zambia does not have wild relatives to maize, the land races are as good as wild relatives, and there is fear that these would be contaminated (Personal communication by Dr. Munyinda Kalaluka and Dr. Davies Lungu, lecturers, School of Agriculture, University of Zambia, 28 April, 2010).

An organic farmer in Chongwe, Mr. Moses Mulenga, who is growing organic crops under the guidance of Kasisi Agriculture Training College, said that he had been practicing organic farming and conservation farming for the past ten years and has not regretted this practice. He said that he had been using kraal manure, green manure and harvest maize stover to enrich his land. He has not gone back to inorganic fertilisers ever since. He also uses organic pesticides for disease and pest control. The yields from his land compares very well with those using inorganic production, and even better yields are recorded. He believes that it is not GMOs but carrying out correct practices that can increase maize production (Personal communication, 10 June, 2010).

According to George Mtonga, a member of staff of the Ministry of Science and Technology, Zambia can develop maize that is drought and flood tolerant to suit the Zambian climatic conditions. He emphasised that “Zambians and scientists just need to be specific as to what they need to do with a particular GMO” (Personal communication, 10 April 2010).

Recognising the value of traditional crops goes beyond production for domestic consumption. It means turning smallholder farmers into entrepreneurs. According to a member of staff of the Ministry of Science and Technology, Mr. Peter Mulenga, Zambia can develop maize varieties that may be drought and flood tolerant to suit the Zambian local climatic conditions. He pointed out that Southern Province was once a “food basket” of Zambia but has lost this capacity due to inadequate rains. Farmers are now drifting to the Northern Province where there are adequate rains. Therefore, if Zambia developed drought resistant maize, they would remain in their province. That means they would not need to move away from their ancestral land. The problem is that we have stopped researching, Mulenga said. He therefore urged Zambian scientists to consider the benefits of GMOs to Zambia as a nation for the drought resistant gene could be developed to boost staple food production in drought prone areas as it has been done with drugs and vaccines such as insulin (Personal communication, 24 April 2011).

Davies Lungu a lecturer at the University of Zambia said that the problem Zambia faces in relation to maize production is reduced moisture for maize growth. He recommended developing drought tolerant crops bred under local weather conditions, unlike importing GM seed maize that is bred under conditions of high moisture in the western countries. Sorghum is known to be tolerant to drought and has been grown and consumed by many Zambians from time immemorial with no side effects. A drought tolerant gene from sorghum could be transferred into maize to develop a maize variety

tolerant to drought. Another good approach would be to identify the gene in the groundnut that is responsible for manufacturing nitrogen from the atmosphere and which makes groundnuts a crop that does not need top dressing fertilisers. The application of top dressing chemical fertilisers to groundnuts would then become unnecessary. This gene could be inserted into maize so that the maize could start fixing its own fertiliser from the atmosphere, thereby cutting the cost of maize production (Personal communication, 28th April 2010).

The commercialisation of agriculture is not just about large international markets but also about vibrant and competitive local markets. According to Moses Zulu, a fifth year student in the School of Agricultural Sciences, farming, irrespective of size and scale, must be considered as business in Zambia. He said that we must think of the commercialisation of agriculture not just for the benefit of the large commercial farms that feed the European Union and the United States but for transforming smallholder farmers into commercial, local entrepreneurs that feed local demands. He noted, however, that the key to creating such local markets needs government investment in rural development to provide roads and storage facilities (Personal communication, 20 April, 2010).

4.4.3 Integrated pest management

Integrated Pest Management (IPM) is a method used to control pests in an environmentally responsible manner. To reduce pesticide dependence in agriculture, integrated pest management protects the environment and our health. It also saves costs and can be applied wherever pests are found. IPM combines different techniques to prevent pest damage without harming the environment. Pests can include insects and mites, rodents and certain birds, plant diseases, and weeds. IPM practices include monitoring, modifying pest habitat, protecting natural enemies and, when needed, the use

of pesticides may be performed in three stages: prevention, observation, and intervention. It is an ecological approach with a main goal of significantly reducing or eliminating the use of pesticides while at the same time managing pest populations at an acceptable cost. Reliance on knowledge, experience, observation, and integration of multiple techniques makes IPM a perfect fit for organic farming (Kogan, 1998: 243). For large-scale, chemical-based farms, IPM can reduce human and environmental exposure to hazardous chemicals, and potentially lower overall costs of pesticide application material and labour. The least hazardous pesticide and the lowest effective amount of pesticide should be used (John *et al.*, 2007:16; Alfieri, 2000b:10).

The success of ecological agriculture rests not only on its immediate outcomes of better and more reliable performance, but also on its ability to address the underlying causes of hunger and poverty. Kenyan farmers obtained bumper crop harvests and higher household income through the practice of the ecological pest management system known as “push-pull” which suppresses insect pests and weed populations in addition to reducing input costs. No amount of lobbying or advertising by Monsanto has ever accomplished this much for an African family (De Fraiture, 2007: 10).

Brother Paul Desmarais, the Director of Kasisi Agriculture Training Centre, maintains that practicing conservation agriculture is the best assurance for sustainable agriculture and food security. He believes that farmer education, an improvement in cultural practices in agriculture, and the adoption of appropriate irrigation methods will ensure production even during times of drought and ensure an all-year round food availability (Personal communication, 23 February, 2010).

Fr. Leonard Chiti, the current director of the Jesuit Centre for Theological Reflection, similarly maintains the “no” position regarding GM maize introduction into Zambia saying that producing genetically modified maize will not automatically guarantee

higher maize yields considering the strenuous climatic conditions and poor soils which have been a catalyst for poor crop yields in Zambia. He insists that resource poor farmers depend on recycled seeds selected and kept within the community every season. Subjecting them to buying expensive seed every season would compromise food security and the main livelihood of rural communities whose mainstay is agriculture. Agriculture needs to be protected as it is related to the dignity of human life. Placing seed control in the hands of a multinational organisation would undermine food security and may change the agriculture system. What is needed is an improvement of the traditional farming systems, promotion of conservation farming and continuous capacity building of the farmers to keep them abreast with new and improved methods of agricultural production (Personal communication, 15 November, 2010).

4.4.4 Plant Breeding

Ever since human beings began to practice settled agriculture more than 8,000 years ago, they have been selecting which plants to grow first from the wild and have then domesticated them in cultivated fields. Early farmers chose plants that not only grew well but that seemed to have the best resistance to changing weather conditions, pests and diseases. The plant populations selected by these farmers are the basis of today's crops that feed the world.

In addition to wild plants and landraces, there is a third type of agricultural plant, namely, those bred on a research farm, either commercial or public. Plant breeders aim, through crossing and selection, to produce varieties that have desirable characteristics such as higher yields, resistance to pests and diseases or better adaptation to their environment. The seed and planting material of these varieties are then supplied to farmers. Breeders need access to plant genetic material with the characteristics they seek, including wild relatives and landraces. Scientists have produced new strains of maize that could cut

vitamin A deficiency among people in developing countries. This has been done through the development of maize with enriched levels of beta carotene, the precursor for vitamin A. The vitamin-fortified maize, developed using conventional breeding methods, could be introduced instead of maize developed by genetic modification. A research team in Zambia reports that they have identified rare variations of a gene known as crtRB1 which occurs only in maize plants from temperate regions (Sawahel, 2008: 1). These result in much higher production, up to 18 fold of beta-carotene, the precursor and main source of dietary vitamin A (ibid.).

Using conventional plant breeding, the researchers have now introduced these variations into tropical maize strains that are commonly grown in developing countries. Poor people in many developing countries depend on cheap foods such as maize that do not provide enough vitamin A supplements. In Zambia, 53 percent of children do not get sufficient vitamin A and the WHO estimates that up to 500,000 children worldwide are blinded each year by Vitamin A deficiency, half of them dying of related causes within a year. Through hybridization, plant breeders have also developed Quality Protein Maize (QPM) that has enriched levels of tryptophan and lysine (two essential amino acids). Breeding work is already taking place in Zambia to transfer the QPM genes into the Zambian maize varieties. It is hoped that the development and availability of QPM maize varieties will scale down the malnutrition levels in Zambia. This is another success story of conventional breeding resulting from hybridization (ibid.).

4.4.5 Organic agriculture

A study by the United Nations Conference on Trade and Development, found that “organic agriculture can be more conducive to ensuring sustainable food security in Africa than most conventional production systems and is more likely to be sustainable in the long

term” (Grange, 2010: 45). This was supported by even the chief agricultural scientist of Punjab, a home of the Green Revolution, who argued that Indian farmers should farm organically (ibid.: 46).

Organic farming improves soil productivity and pest control by excluding or strictly limiting the use of synthetic fertilizers and synthetic pesticides, plant growth regulators, livestock antibiotics, food additives, and genetically modified organisms. Organic agricultural methods are internationally regulated and legally enforced by many nations, based in large part on the standards set by the International Federation of Organic Agriculture Movements (IFOAM), an international umbrella organization for organic agriculture established in 1972. IFOAM defines the overarching goal of organic farming as a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and to promote fair relationships and a good quality of life for all involved (John *et al.*, 2007: 23).

Mixed farms with both livestock and crops can operate in a way that improves soil fertility through growing nitrogen-fixing forage grasses such as white clover or alfalfa and they can grow cash crops or cereals when fertility is established. Horticultural farms growing fruits and vegetables which operate in protected conditions are often even more reliant upon external inputs (Smill, 2001).

Agriculture, in general, imposes external costs on society through pesticides, nutrient runoff, excessive water usage, and assorted other problems. As organic methods minimize some of these factors, organic farming is believed to impose fewer external costs upon society. An assessment of agriculture conducted in 2000 in the UK determined total external costs for 1996 at 2,343 million British pounds or 208 pounds per hectare. An

analysis conducted in the USA in 2005 regarding these costs revealed that cropland imposes approximately 5 to 16 billion dollars (\$30 to \$96 per hectare), while livestock production imposes 714 million dollars. Both studies concluded that more should be done to internalise external costs (Lotter, 2003: 26). Although neither included subsidies in their analysis, they noted that subsidies also influence the cost of agriculture to society. Both focused on purely fiscal impacts. The 2000 review reported pesticide poisonings but did not include speculative chronic effects of pesticides, and the 2004 review relied on a 1992 estimate of the total impact of pesticides.

Most organic farms use fewer pesticides than farms under conventional agriculture production. Some pesticides cause damage to the environment or, with direct exposure, to human health. The five main pesticides used in organic farming are a bacterial toxin, pyrethrum, rotenone, copper and sulphur. Surveys have found that fewer than 10 percent of organic farmers use these pesticides regularly. One survey found that only 5.3 percent of vegetable growers in California use rotenone, while 1.7 percent uses pyrethrum (*ibid.*). Reduction and elimination of chemical pesticide use is technologically challenging (Kuepper *et al.*, 2004: 45).

Pesticide runoff is one of the most significant effects of pesticide use. The American Natural Resources Conservation Service tracks the environmental risk posed by pesticide water contamination from farms. It concluded that "the nation's pesticide policies during the last twenty six years have succeeded in reducing overall environmental risk, in spite of slight increases in areas planted and the weight of pesticides applied. Nevertheless, there are still areas of the country where there is no evidence of progress, and areas where risk levels for protection of drinking water, fish, algae and crustaceans remain high" (*ibid.*).

Organic food is widely believed by the lay public to be healthier than conventional food, although the research is inconclusive. Animals that are fed organic diets appear to have slightly better health and reproductive performance, but similar tests have not been performed on humans. Some vegetables and cereals have a higher quality protein though of lower concentration and higher vitamin concentration. Organic food is said to be as safe to consume as any other kind of food. Just as with any kind of produce, consumers should wash it before consuming to ensure maximum cleanliness. As cited above, organic produce contains significantly lower levels of pesticide residues than conventional produce. *E.coli* contamination has been blamed on organic food because of raw manure application. However, organic standards set strict guidelines on manure use in organic farming: either it must be first composted, or it must be applied at least 90 days before harvest which allows ample time for microbial breakdown of pathogens.

Concerns have been raised that the higher expense of organic food, ranging from 45 percent to 200 percent, could limit the recommended consumption of five servings per day of vegetables and fruits which are thought to improve health and reduce cancer regardless of whether they are organic or conventional. Two studies have found that children who ate organic diets experienced significantly lower organ phosphorus pesticide exposure than children fed on conventional diets. Although the researchers did not collect health outcome data in this study, they concluded that “it is intuitive to assume that children whose diets consist of organic food items would have a lower probability of neurologic health risks” (Msangi, 2008: 12).

A study conducted in 2007 found that consumption of organic milk is associated with a decrease in risk for eczema, although no comparable benefit was found for organic fruits, vegetables, or meat (John *et al.*, 2007: 46). The cost of organic food is higher than that of conventional food because the organic price tag more closely reflects the true cost of

growing the food, i.e., substituting labour and intensive management for chemicals along with the health and environmental costs which are borne by society. These costs include clean-up of polluted water and remediation of pesticide contamination. Prices for organic foods include costs of growing, harvesting, transportation and storage (ibid.: 47).

In the case of processed foods, processing and packaging costs are also included. Organically produced foods must meet stricter regulations governing all these steps than conventional foods. The intensive management and labour used in organic production are frequently thought to be more expensive than the chemicals routinely used on conventional farms. There is mounting evidence that if all the indirect costs of conventional food production were factored into the price of food, organic foods would cost the same or, more likely, would be cheaper than conventional food. Cost, however, is very dependent upon market venue and consumer product choice. It is possible to consume a moderately priced diet of organic foods by purchasing directly from farmers at venues such as farmers' markets, and by purchasing unprocessed organically grown foods at the grocery store (ibid.: 48).

Organic farmers build healthy soils by nourishing the living component of the soil, i.e., the microbial inhabitants that release, transform, and transfer nutrients. Organic farmers feed soil biota and build soil structure and water-holding capacity through application of organic matter, cover crops, compost, and biologically based soil amendments including sophisticated crop rotations to manage the field ecology, effectively disrupting habitat for weeds, insects, and disease organisms. These produce healthy plants that are better able to resist disease and insect predation. The farmers' primary strategy in controlling pests and diseases is prevention through good plant nutrition and management. Soil organic matter contributes to good soil structure and water-holding capacity. Weeds are controlled through crop rotation, mechanical tillage,

and hand-weeding, as well as through cover crops, mulches, flame weeding, and other management methods. Organic farmers rely on a diverse population of soil organisms, beneficial insects, and birds to keep pests in check. When pest populations get out of balance, growers implement a variety of strategies such as the use of insect predators, mating disruption, traps and barriers. Under the National Organic Program Rule, growers are required to use sanitation and cultural practices first before they can resort to applying a material to control a weed, pest or disease problem. Use of these materials in organic production is regulated, strictly monitored, and documented. As a last resort, certain botanical or other non-synthetic pesticides may be applied (ibid.: 49).

4.4.6 Cutting crop losses by improving food storage

According to the Food and Agriculture Organization of the United Nations, 15 to 35 percent of food harvested is lost during storage, especially in developing countries. This loss is caused by a number of factors such as harvesting too early or too late, exposure to rain, drought and extreme temperatures, pest and disease damage. In addition, food is also lost from spillage, crop damage from tools, chemical contamination, and rough handling during harvesting, loading, packing and transportation. All these factors affect food security and lead to a reduction of farmers' income by removing part of the food supply from the market. However, this state of affairs can be controlled through the use of traditional crop storage techniques (Anthony, 2008: 1).

One of the techniques used is the application of natural repellents such as locally available plants. In the past, traditional farmers used to conserve their crops through the use of traditional techniques such as ash and plants. They thus managed to conserve their crops up to the following farming season. These techniques can still be beneficial to local farmers today. Therefore, it is advisable for small scale farmers to find out from fellow

local farmers and herbalists about locally available plants they can use to protect stored crops and ensure food security. Furthermore, farmers have to ensure that stored crops stay dry (ibid.: 2).

Another way to solve the crop storage problem is to grow crops that do not suffer much damage in storage such as finger millet. In some cases, traditional crops are not grown any longer because they are considered poor people's food. But if one talks to older farmers, one may discover that there are traditional crops which do not have storage pests. In other cases, crops which are new to an area may have storage pests (Sissoko, 2007: 1).

Further, crop storage can be improved through ground storage techniques. Crops such as cassava and sweet potatoes can be conserved by underground storage until they are ready to eat or be sliced into chips and dried before storage. Therefore, for some crops, underground storage can minimize pest damage, especially when underground storage prevents damage from serious above-ground pests (ibid.: 2).

In addition, the making and using of a solar dryer can improve food storage and reduce crop losses. Solar dryers are inexpensive, prevent crops from rotting, and allow producers to sell dried crop products after the main harvest season when prices are higher. In this way, farmers can experiment with other crops and crop products that can be dried, especially those which are not usually dried (Tetalovic, 2009: 1).

Vegetables can also be stored as leaf powders resulting from vegetable leaves that have been dried and ground into powder. Vegetables preserved and stored in this manner can be stored for long periods to be consumed during drought periods. They can be mixed with grain and cooked. The leaf powder is very high in protein and vitamin A. Making leaf powder is a good way to ensure that the vitamins contained in green leafy plants are available throughout the year (Mandal, 2008: 1).

Another major way of cutting crop losses is through the combination of traditional knowledge and scientific experimentation to improve traditional storage structures. Such a combination can result in effective crop storage and reduction in crop losses. Therefore, farmers need to find out whether there are ways to use the principles behind modern storage techniques to improve traditional practices (Weixiao, 2008: 4).

Finally, bugs can also be eliminated from stored crops through the use of simple technologies such as those which harness the heat of the sun. This can help to protect crops against crop pests. Therefore, it is important that farmers in different areas find out if there are other ways in which the heat of the sun can be harnessed to protect stored crops (Anthony, 2008).

4.4.7 Is donor GM maize the answer to food security?

Food is a basic human need, and producing enough to feed the growing population of developing nations is one of the biggest challenges facing the modern world today. Three out of four people in the developing world depend directly or indirectly on agriculture for their livelihood. Indeed, for most low-income countries, agriculture is the most important sector of the economy, generating up to one half of gross domestic product and often the main source of foreign currency (Bassey, 2009: 18).

One of the many ways in which agriculture can be made more productive is by harnessing science to improve the productivity of staple food crops. A range of agricultural research programmes are currently under way to achieve this. As a result, global food productivity is undergoing a process of rapid transformation. However, new technologies do not favour poor low input farmers who lack the capacity to engage in new production technologies. As agriculture is the main economic activity of rural communities, improving agricultural production in developing countries is fundamental to

reducing poverty and increasing food security (Msangi, 2010: 34). However, agriculture must also be sustainable. In the past, many parts of the developing world have suffered from unsustainable agricultural activities (ibid.:35).

The World Bank and UN agencies under the International Assessment of Agriculture Knowledge, Science and Technology for Development (IAASTD) have completed the most comprehensive analysis of world agriculture to date. This four year study by more than 400 scientists and development experts from 80 countries found that reliance on resource extractive industrial agriculture is risky, particularly in the face of worsening climate, energy and water crises. The IAASTD highlighted the need to build more resilience into our food systems by increasing investments in agro-ecological sciences, small scale bio-diverse farming methods and farmer-led participatory breeding programs (Padma, 2008: 16).

Most biotechnology innovations that are available today bypass poor farmers, firstly, because these farmers cannot afford the seeds that are protected by patents owned by biotechnology corporations. Secondly, because this modern technology is not adapted to the marginal environments where resource-poor farmers live and work (Perley and Lantin, 2000). An estimated 850 million people live on land threatened by desertification. Another 500 million reside on terrain that is too steep to cultivate. Moreover, most of the rural poor live in the tropics, a region that is most vulnerable to the effects of global warming and climate change. About two billion people have been untouched by modern agricultural science because of these limitations (Glover, 2010: 4).

Biotechnology researchers pledge to counter problems associated with food production in such marginal areas by developing GM crops with traits considered desirable for small and medium scale farmers, such as enhanced resistance against weeds and drought tolerance. However, agricultural biotechnology innovations (e.g., *Bt* crops and

herbicide resistant crops) are profit driven rather than need driven (Conway, 1997). The real thrust of the genetic engineering industry is not to make agriculture more productive but to generate profits (Glover, 2010: 4). In the case of herbicide tolerance, the goal is to win greater herbicide market-share for proprietary product and to boost seed sales at the cost of damaging the usefulness of a key pest management product that is relied on as an alternative to insecticide (Carpenter, 2010: 13).

Even if biotechnology contributes to increased harvests, poverty will not necessarily decline. Many poor farmers in developing countries do not have access to cash, credit, technical assistance, or markets. The so-called Green Revolution of the 1950s and 1960s by-passed such farmers because planting the new high yielding crops and maintaining them through the use of pesticides and fertilisers were too costly for impoverished landowners. Data show that in both Asia and Latin America, wealthy farmers with larger and better endowed lands profited from the Green Revolution (Sharma, 2002), whereas farmers with fewer resources and cultivating in marginal soils often gained less (Lappé and Bailey, 1998: 72). The Gene Revolution might only end up repeating the earlier mistakes. Genetically modified seeds are under corporate control and patent protection and, consequently, are very expensive (Conway, 2000; Campbell, 2009: 23). There is thus need to develop non expensive affordable seeds for all farmers.

Poor farmers do not fit into the profitable marketing niche of private corporations whose focus is on biotechnological innovations for the commercial-agricultural sectors of industrial and developing nations. The private sector often ignores important crops such as cassava, which is a staple food for 500 million people worldwide. The few impoverished landowners would become dangerously dependent on the annual purchase of genetically modified seeds. These farmers would have to abide by an onerous intellectual property agreement not to plant seeds yielded from the harvest of bioengineered plants. In the USA,

farmers adopting transgenic soybeans must sign an agreement with Monsanto and must buy seed every year. Should they recycle the seed, the penalty is about \$3,000 per acre and, depending on the acreage, this could cost the farmer a fortune in penalty charges. Seed companies are determined to extract the most profit from their investment (Pratchaya, 2009: 11).

Felix Mwaangala of NISIR noted that any illegal imports would be rejected and the importer prosecuted, as was the case in 2008 when a consignment of illegally imported GM maize was rejected and sent back by the government of Zambia (Personal communication, 6 April, 2009). Dr. Davies Lungu, a lecturer at the University of Zambia, felt that the lack of safety regulations to inform Zambians on the safety of GM maize was a matter of concern (Personal communication, 28 April, 2010).

4.5 Reasons for the decision taken by government

One of the reasons for refusing GM maize was that Zambia has not yet developed a biotechnology and bio-safety policy, nor has it passed legislation to deal with these matters. Neither has it yet ratified the Cartagena Protocol dealing with trans-boundary movements of GMOs. This requires advance informed consent to be given by recipient countries. Furthermore, health concerns were evoked based on the following reasons: (i) GM food might increase antibiotic resistance because of the widespread use of antibiotic resistance marker genes in the development of GM products. The majority of Zambians eat maize in a semi-processed or unprocessed form as the staple food, and usually as a main source of carbohydrates. So its impact would be different, since maize and its by-products are consumed for breakfast, lunch, supper and as a snack in between meals; (ii) another consideration was that the likely recipients of the food aid are the most vulnerable members of the society - the old, women and children, some of whom may be in a poor

state of health and may already have their immune systems compromised (Emsley, 2001); (iii) environmental concerns were based on the fear of genetic contamination of indigenous maize varieties, assuming that some recipients of the GM maize as food aid would save some of it for planting since it came in the form of grain. This could lead to the loss of agricultural diversity in Zambia; (iv) most importantly, after assessing all the aforesaid gaps, the Zambian government decided to apply the precautionary principle as adopted during the United Nations Conference on Environment and Development (The Rio Declaration) and the Cartagena Protocol. It evoked the precautionary principle in not accepting the GM maize, because the country did not have a regulatory framework and an appropriate infrastructure to cope with the scientific assessment that was required before the deliberate introduction of GM food products.

The majority of participants to the debate urged the government of Zambia not to accept GM maize due to its potentially harmful effects to people as well as to the environment. On the other hand, only a few participants spoke in favour of accepting the GM food aid on the basis that it would save many lives from starvation (Banda, 2002).

4.6 Summary

This chapter has discussed and analyzed the arguments for and against the use of GMOs in Zambia and the ethical concerns raised by the debate on GMOs in view of the negative effects of GMOs on human health and on the environment. It has also explained the reasons given by the government for its decision to ban the use of GMOs, namely, that Zambia had not yet developed a biotechnology and bio-safety policy, that it had not passed legislation to deal with these matters, that it had not ratified the Cartagena Protocol dealing with trans-boundary movements of GMOs, and that there were both health concerns and environmental concerns with regard to the possible impacts of GMOs.

CHAPTER 5

ETHICAL EVALUATION

5.1 Introduction

From an ethical point of view, in coming to a decision regarding the advisability of accepting food aid in maize especially, there is need to protect both the health of the people and of the environment. The advantages and disadvantages of allowing GMO foods into the country have been discussed along with the problems relating to the possible negative effects of GMOs. Viable alternatives have also been discussed.

With regard to the decision taken by the government in banning GMOs for the present at least, this chapter will now apply the following ethical approaches, namely, the principle of informed consent, the common good, the right to safe food, the dignity of human life, the justice/fairness approach and the autonomy of the nation as outlined in chapter three. The precautionary principle will also be applied. This chapter, therefore, refers to our third objective which was to examine what ethical evaluation can be made of the Zambian government's position on genetically modified maize.

5.2 Informed consent

Informed consent is a fundamental requirement in ethical decision making. The person or persons involved must have adequate information relating to what they are being asked to give consent to and that they must give their consent freely and not under any form of coercion. According to the international convention on bio-safety, an informed consent must be signed by both parties (the donor and the recipient country) before any action is taken (Kuyek, 2002b: 5). However, the WFP brought part of the relief food into the country without the prior consent of the Zambian government. This state of affairs violated the recommendations of the convention on bio-safety which recommends that an

informed consent be signed between the donor and the recipient country. People have the right to information. Therefore, Zambians had the right to know the type of food they were going to consume and the type of GMO they were dealing with. Unfortunately, no such information was given, nor was information given concerning safety assessments conducted before commercialising the product. In addition, at that time, the Zambian government did not have a safety framework to be able to assess the safety of GM food. It also transpired that for some years, the WFP had been providing GM food aid to African countries without their prior informed consent. According to Judith Lewis, WFP's Director for Southern and Eastern Africa, "all famine blighted countries had in recent years received US GM maize as part of food aid" (Djokotoe, 2002: 5).

5.3 The common good

Some proponents of GMOs argued in favour of GM maize on the basis that long term effects should not be a concern because they are not proven. This prompted the question "If long term effects come after 30 years, how many of us would be there?" (Shonga, 2002: 9). Such a question, however, implies a denial of responsibility for the future. The natural environment and its biodiversity are a common good that should not be manipulated at the expense of future generations. The common good refers to certain general conditions that are equally important to everyone's advantage. In other words, it is the sum total of those conditions of social life which allow social groups and their individual members ready access to their own fulfilment. The common good is not just restricted to social systems and institutions but also includes the natural environment on which we all depend and work in a manner that benefits all people. Therefore, we have an obligation to maintain biodiversity. The natural environment has a powerful impact not only on the well-being of today's members of society but also on those of future

generations. It is a duty of every human being to care for the earth and to ensure that our natural resources are conserved for future generations (Douglass, 1980: 52).

The Zambian government should invest in research to identify GMOs that are beneficial to Zambian farmers, and especially to develop drought tolerant maize varieties to benefit farmers that live and cultivate in valley areas where rainfall is erratic and insufficient for efficient agricultural production. However, it is still not clear whether such drought tolerant GM maize would not have side effects on the health of consumers as well as on the environment. Even if the Zambian people wanted research in specific areas of GMOs to suit Zambia's weather patterns, the multinational corporations like Monsanto would not be willing to engage in such investment because the cost of such development would be higher than the profits as not many nations would buy such gene development. These technologies tend to be developed in response to market pressures and not to the needs of the poor who have low buying power.

5.4 The right to safe food

The right to food is a fundamental human right. Article 25.1 of the Universal Declaration on Human Rights focuses on the food rights of every individual. However, the right to food should not be misunderstood to mean food at all costs, but safe food. The human right to safe food is recognized in several instruments under international law. The right to safe food, which was adopted by the UN Committee on Economic, Social and Cultural Rights (CESCR), affirms that it is indivisibly linked to the inherent dignity of a human being and indispensable for the fulfilment of other human rights such as the right to health and the choice of food (Chabala, 2002b). In other words, it asserts that such should be safe (free from adverse substances) and acceptable within a given cultural context (Macer, 2003: 16). However, the fact that there was no information concerning the assessment that

was done before exporting GM maize to Zambia, in addition to the country's incapacity to assess the safety of the product, made it difficult to ascertain its safety, hence the need for precaution (Chabala, 2002b). The "precautionary principle" needs to be upheld and the lack of informed consent infringes a key ethical principle.

It is evident that lack of food leads to malnutrition and a reduction in the ability of people to make decisions concerning the type of food they would like to eat as demonstrated, for example, by the WFP Communications Officer when he reported that, "two people died after consuming wild fruits" (Shabolyo, 2002: 1). However, this does not mean that they have to be given food at all costs without assessing its safety. Safe food refers to the quality of food required for normal physical and human activity and development, not just for survival. It is the responsibility of any government to provide safe food for people in vulnerable situations. The right to food implies the right to produce or procure the food one needs, and it demands that those who, for reasons beyond their control are unable to do so, be provided for. The right to safe food is thus relevant to all consumers and farmers, as well as to those who are unable to produce or procure their own food. In this last instance, international law recognizes that everyone, at the very least, must be given enough food to ensure their freedom from hunger. This right may be fulfilled through food aid and through assistance that enables people to become consumers and farmers (Macer, 2003: 14). However, the right to adequate food should not primarily be regarded as a right to receive a specific type of food aid without establishing its safety, because other problems may be created in trying to solve one problem (Douglass, 1980: 43).

At the time of the crisis, GM maize appeared to be safe since it was announced that it had been consumed for a number of years without side-effects. However, this was no guarantee that it would not have negative effects in another context. According to Dr.

Felix Mwaangala of the National Institute for Scientific and Industrial Research (NISIR), the Zambian government did not say “no” to GMO maize but it applied the precautionary principle which requires caution in handling GMOs. So, Zambia would need to wait until there would be assurance of the safety of the GM maize. The Zambian people said “no” to GMO maize until there were means available to verify the safety of the maize meant for human consumption. Unfortunately, the required equipment to ensure this safety was not available at the time of the debate.

At present (2011), Zambia is testing GMO presence in the maize with the technology acquired with the assistance of the Norwegian government which has trained Zambian personnel on how to use the equipment to detect GMO presence in maize. NISIR is testing samples of maize grains collected from the borders, from refugee camps, from seed companies and from FRA sheds around the country. The exercise is to detect and establish the presence of the promoter gene in the maize that was donated to Zambia by the United States in 2002.

By April 2009, 6000 samples were collected for testing. If maize was found to be contaminated, mitigation factors would then be applied. Some measures could be to zone GM maize, to institute police controls at entry points and to protect other maize from contamination. The Bio-safety Policy is also in place to guide those who would want to bring GM products into the country, but that there would be no permit on importation of crop or livestock of strategic importance in which category maize falls (The Biosafety Act, 2007: (10), 154). The National Bio-safety Authority under the Ministry of Science and Technology is responsible for verifying applications for importing GM products.

5.5 The dignity of human life

The dignity of human life comes from the fact that life has unique intrinsic value. Therefore, whatever one does must be done in a way that helps to preserve life. Hence, in whatever decision has to be taken, saving human life should be the guiding principle. The consumption of safe food is related to the fulfilment of other rights such as the right to health and choice of food. These rights are indivisibly linked to the dignity of a human being. If the GM maize assessments had been available and had shown that the product was safe, the decision of the Zambian government would have been different (Mupuchi, 2002b). However, in the absence of such information, there was no basis upon which one could affirm that the product was safe for human consumption.

Human dignity implies that everyone has a legitimate claim to the goods and services required to live a truly human life, and not just for survival. Hence, the USA could have sourced maize from countries as listed in the table below for export to Zambia as humanitarian aid (Mupuchi, 2002a). This demonstrates that GM maize was not the only option to starvation in Zambia in 2002 (Clay and Stokke, 1991).

Table: Non-GM maize sources in Africa in October 2002

<u>Country</u>	<u>Exportable Maize in Metric tons</u>
Kenya	10, 000
Tanzania	50, 000
South Africa	1, 020, 000
Uganda	80, 000
<u>Total Available</u>	<u>1, 160, 000</u>

*Source: FAO, Global Information and Early Warning system (2002)
Food supply and crop prospects Report, Rome: FAO.*

5.6 The principle of justice/fairness

The principle of justice or fairness requires that equals be treated equally. However, the relationship between Zambia and the donor countries is not one based on equality. The power structure is uneven. Consequently, Zambia did not have an equal opportunity in choosing where aid maize would come from. This was an infringement of the principle of justice or fairness. Furthermore, on the basis of the precautionary principle, it was neither fair nor just to take undue risks with people's health. This is related to the following approach with regard to the autonomy of the nation.

In terms of environmental distributive justice, the burdens that would have been imposed on the people's health in view of the risks involved in consuming GM maize was not justified in view of the lack of adequate security procedures in advance. Moreover, the lack of adequate input by the people into any decision to allow GM maize into the country would have been an infringement of participatory justice.

5.7 The autonomy of the nation

Autonomy refers to the capacity of a rational individual or society to make an informed, un-coerced decision (Douglass, 1980: 23). The US government as well as the UN agencies tried to use the vulnerable situation in Zambia to pressurize the government to accept GM maize. By adopting "accept or starve" discourses, the US and UN agencies were indirectly coercing the Zambian government to accept GM maize as food aid as no other alternatives appeared to have been available. Such an approach was tantamount to undermining the sovereignty or the autonomy of the Zambian state. Aid can be accepted or rejected depending on the decision of the recipient country. Further, the donation was brought in the form of corn and not in cash. This meant tying the recipient country specifically to the US agricultural surplus. The recipient country, Zambia, should have been given freedom to source the most convenient food maize from other surpluses, to explore diversified

sources, and to build local infrastructure for future drought mitigation strategies. Thus, despite being a signatory to the 1999 food aid convention which specifies that food aid should be sourced in the most cost effective manner, the US decided to act otherwise. Powerful nations should conduct themselves as partners and not impose on weaker nations. In food aid situations, one cannot disregard the identity and self-esteem of the people involved (Richard, 2004: 1). This implies that donor countries should consider recipient countries in situations of crisis by respecting their social, cultural and religious norms on what is or is not preferred as food (Clay, 2000: 26).

Given the government's point of view regarding the rejection of the GM maize food aid donated by the USA government through the WFP, the Acting Director for Science and Technology, Jane Mubanga Chinkusu, said that the government was justified to reject GM maize delivery into Zambia. This was done based on the information provided to the government after wide consultations conducted by a consultative group of local scientists and ordinary Zambians constituted by the President, Mr. Levy Patrick Mwanawasa. After visiting many countries, the group came up with a situation analysis and advised the President to say "no" on behalf of all Zambians. The information gathered showed that GM maize was potentially unsafe because it was difficult to see the side effects of GM food consumed ten years down the line.

Seed patenting by multinational corporate entities would mean compromising food security because the usage of and access to seed would be controlled by patent owners with the result that small scale farmers, who depend on recycled local seeds, would lose their seed and therefore their ability to produce food for the Zambian people. Seed companies producing GMO seeds look to Africa as a mere market for their GMO products. Issues of food insecurity in Zambia do not only result from poor seed but from climatic conditions. For example, floods and droughts have a major impact on crop

production. Hence, GMOs cannot solve food insecurity in Zambia. With good rainfall and improved cultural practices, Zambia can have good harvests and food security. America produces maize for animal consumption while humans eat rice which is not genetically modified. Rice consumers are not affected by GMOs; it is the maize eaters in Africa that are faced with such issues. A technology developed under different weather conditions in one country may not perform wonders in another country with different weather patterns. China is a success story today because it continues to invest in rural development and in creating a demand for local markets. We cannot talk of transforming and solving food security without investing in small farmers who control 20 percent of the global food trade (Church, 2010: 38).

5.8 Conclusion

In view of what has been stated above, the ethical approaches discussed support the decision of the government to ban GMO food aid. However, it is important to note that while section 10 of The Biosafety Act of 2007, allows for the Biosafety Authority's prior approval before any person can undertake to research on, develop, produce, import, export, release or place on the market of any GMO or its products, section 11 states that no approval shall be made for any application to handle GMOs of crops and livestock of strategic importance to food security (The Biosafety Act, 2007, (10-11):154). The Minister may by statutory instrument make provision for a list of such crops and livestock of national importance and food security (ibid.).

5.9 Summary

This chapter has applied the following ethical principles and theories to the government's decision to ban GMOs, namely: informed consent and the precautionary principle, the

common good, the right to safe food, the dignity of human life, the principle of justice/fairness and the autonomy of every nation. These ethical approaches are seen to support the government's decision with respect to the health of the people of Zambia and of the environment.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Overall summary

The study had three objectives which are as follows:

- i. to review the Zambian debate for and against genetically modified maize;
- ii. to identify the ethical concerns about genetically modified maize; and
- iii. to make an ethical evaluation of the Zambian government's position on genetically modified maize.

The first objective of this study was to review the debate regarding government's position on GM maize that was donated to Zambia by the US government through the World Food Programme. The GM maize donation was to supplement food shortages experienced by communities affected by droughts following a drought period of the 2001/2002 agriculture season that had affected their crop yields and resulted in hunger and vulnerability.

The second objective was to identify the ethical concerns about genetically modified maize. Proponents of GM maize argued that it was necessary to make maize available to people that were threatened with starvation due to low levels of maize stocks regardless of whether the maize was GMO or not. They insisted that a number of people from drought affected areas of Zambia in 2002 risked starving to death if no immediate solution was found to the food crisis and the fact that GM maize was readily available in the country for distribution. Opponents of GM maize, however, argued that human health and the environment would be threatened as the consumption of GM maize would have the potential to provoke allergic reactions to a "foreign gene". These arguments were seen to be more numerous and stronger than those for GMOs in view of alternatives available. The possible negative effects of GMO food aid were seen to infringe the precautionary

principle. An ethical solution to food security in Zambia should ensure both human and environmental health by avoiding foreseeable risks.

The third objective was to make an ethical evaluation of the Zambian government's position on genetically modified maize. One of the ethical issues raised was related to informed consent. Contrary to the recommendations of the international convention on bio-safety for the informed consent between the parties involved, before any action is taken, the WFP brought part of relief food into the country without prior consent of the Zambian government. People have a right to know the type of food they consume and its safety. Unfortunately, there was no information available about the type of genetic engineering from the manufacturer and the safety assessments conducted before commercialising the product. At the time, the Zambian government had no capacity to assess the safety of GM food. The fact that there was no transparency in the procedure is an issue of great concern that demanded precaution.

The common good raised concern when it was argued by the proponents of GMO food that effects of GM may take effect after a long time when this generation has been long gone. But the natural environment and its biodiversity are a common good that should not be manipulated at the expense of future generations. It is a duty of every human being to care for the earth and to ensure that our natural resources are conserved for future generations

The right to safe food was another issue of concern. The human right to safe food is recognized in several instruments under international law. The right to safe food is directly linked to the dignity of a human being. Safe food refers to the food that helps human beings to realise the fulfilment of others' human rights such as the right to health and choice of food. Therefore, such food should be safe and acceptable within a given

cultural context. However, the fact that there was no information concerning the safety of GM maize called for caution.

The dignity of human life was another concern in the debate. Food is not only meant for survival. It must be food that helps to uphold the dignity of a human person. That means it should enable human beings to fulfil other rights such as the right to health and choice of food. However, the fact that the safety of GM was not established made it difficult to ascertain if it fulfilled the characteristics of safe food that upholds human dignity, hence the need for precaution.

Additionally, cross pollination between the GM and native crops was another concern. The environment and biodiversity are a common good that does not need to be manipulated. Every generation has an obligation to maintain biodiversity because it has a powerful impact on the well-being not only of today's members of society but also of those of future generations. Therefore, the fact that there was the possibility for cross pollination and affecting the country's biodiversity made it necessary to be cautious.

The principle of justice/ fairness was raised in the debate in that there seemed to be an infringement of the principle of fairness and justice because Zambia was not given an opportunity to choose the type of food aid. The US in its delivery of food aid to Zambia displayed an uneven playing field showing an uneven power structure. The US dictated the terms and conditions of food assistance. The government of Zambia in exercising justice and fairness to its people had to apply the precautionary principle in the view that not much was known about the effects of GMO maize on the people of Zambia and there was no scientific proof to show that maize was safe for human consumption.

Finally, the principle of national autonomy was also raised in the debate. The fact that the US government as well as the UN agencies tried to pressurize the Zambian government to accept GM food were indirectly undermining the sovereignty of the

Zambian state. Further, the donation was brought in the form of corn and not in cash thereby tying the recipient country specifically to GM maize. The fact that Zambia is a sovereign state justifies the move by the government to decide without any external influences.

6.2 Conclusion

Based on the foregoing ethical issues, any measures to ensure food security must take into consideration issues related to informed consent, the precautionary principle, the common good, and the right to safe food, the dignity of human life, the principle of justice/fairness and the autonomy of the nation. Biotechnology alone is not the answer to food security in Zambia because it bypasses poor farmers. Farmers cannot afford the seeds that are protected by patents owned by biotechnology corporations. The new technology may not adapt to the marginal environments of poor farmers. Therefore, agro-ecology is a better way of improving food security in Zambia. Some of the approaches identified include sustainable agriculture, organic farming, integrated pest management, plant breeding and food storage improvements. The fact that the aforementioned measures have been identified as alternatives to GM maize implies that they are safe and free from environmental degradation and are thereby suitable for ensuring food security in Zambia.

The study shows that GM maize is not a solution to food security in Zambia because of its potential health and environmental risks. More importantly, GM maize is not suitable for the Zambian farmers, most of who are resource poor and cannot afford purchasing seeds every season.

6.3 Recommendations

Zambia needs to scale up research into the production of indigenous food crops such as sorghum, millet and cassava. These are crops which are consumed by many people in

Zambia, especially in periods of drought. These crops are also resistant to drought and low rainfall, and hence are able to survive on low moisture. Consequently the following recommendations are made:

1. The Zambian government to come up with major changes in policies, institutions, research and development to ensure that agro-ecological alternatives are adopted, made equitably and broadly accessible, and multiplied so that their full benefit for sustainable food security is realised.
2. The ultimate challenge is to increase budgetary allocation to the agriculture sector, increase investment, and research in agro-ecology and to scale up projects that have already proved successful to some farmers, like conservation farming which uses a holistic approach to increased agriculture production while improving the soil.
3. The Zambian government and international public organisations should encourage and support effective partnerships between NGOs, research/ local universities, and farmer organisations in order to assist and empower farmers to achieve food security, income generation, and natural resource conservation.
4. Improved breeding techniques on available varieties that give timely/ reliable result.
5. To invest in public education regarding GM products, particularly through radio and TV programmes. Education would enable consumers to make informed decisions regarding consumption of GM products.
6. To monitor behaviours of the powerful nations such as the USA against pushing unwanted, unregulated and potentially harmful technology on the Zambian people.

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APPENDICES

Appendix I: The Cartagena Protocol on Biosafety

Introduction

The Cartagena Protocol on Biosafety to the Convention on Biological Diversity, is the result of the Convention on Biological Diversity held in Nairobi in 1992 and 1995 which was finalised in and adopted by the conference of Parties in 2000. The conclusion of the Cartagena Protocol has been held as a significant step forward in providing an international regulatory framework to reconcile the respective needs of trade and environmental protection with respect to a rapidly growing global biotechnological industry. The Protocol therefore provides an enabling environment for the environmentally sound application of biotechnology to derive maximum benefit from the potential that biotechnology has to offer, while minimising the possible risks to the environment and to human health (Secretariat of the Convention on Biological Diversity, 2000 (1)).

An Overview of The Cartagena Protocol on Biosafety

The Bio-safety Protocol, which came into effect on 11 September 2003, seeks to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology. It makes clear that products from new technologies must be based on the precautionary principle and allows developing nations to balance public health against economic benefits. It will for example let countries ban imports of a living modified organism if they feel there is not enough scientific evidence that the product is safe. This was born out of the United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit, held in Rio de Janeiro, Brazil,

in June 1992, when the Rio Declaration on Environment and Development, was adopted, which contains 27 principles to foster sustainable development.

Principle 15, commonly known as the precautionary principle, states: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

What the Protocol covers

The Protocol applies to the trans-boundary movement, transit, handling and use of all living modified organisms that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health. Decisions by the party of import on whether or not to accept the import of LMOs are taken under its domestic regulatory framework that is consistent with the objective of the Protocol. A developing country Party or a Party with an economy in transition may, in the absence of a domestic regulatory framework, declare through the Bio-safety Clearing-House that its decisions on the first import of LMOs, will be taken in accordance with risk assessment as set out in the Protocol and time frame for decision-making (Cartagena Protocol 2003).

The Protocol promotes bio-safety by establishing rules and procedures for the safe transfer, handling, and use of LMOs, with specific focus on trans-boundary movements of LMOs. It features a set of procedures including one for LMOs that are to be intentionally introduced into the environment called the advance informed agreement procedure, and one for LMOs that are intended to be used directly as food or feed or for processing. Parties to the Protocol must ensure that LMOs are handled, packaged and transported under conditions of safety. Furthermore, the shipment of LMOs subject to trans-boundary

movement must be accompanied by appropriate documentation specifying, among other things, identity of LMOs and contact point for further information. These procedures and requirements are designed to provide importing Parties with the necessary information needed for making informed decisions about whether or not to accept LMO imports and for handling them in a safe manner. The Party of import makes its decisions in accordance with scientifically sound risk assessments. The Protocol sets out principles and methodologies on how to conduct a risk assessment. In case of insufficient relevant scientific information and knowledge, the Party of import may use precaution in making their decisions on GMO imports. Parties may also take into account, their international obligations, and socio-economic considerations in reaching decisions on using GMOs to promote food security and eradicate hunger. Parties must also adopt measures for managing any risks identified by the risk assessment, and they must take necessary steps in the event of accidental release of living modified organisms. To facilitate its implementation, the Protocol established a Bio-safety Clearing-House for Parties to exchange information, and contains a number of important provisions, including capacity-building, a financial mechanism, compliance procedures, and requirements for public awareness and participation.

Appendix II: Discussion guide for Ministry of Science and Technology

In 2002 at the height of Zambia's food shortages when people of Zambia in some communities were faced with starvation, the Zambian government rejected food aid in form of maize brought into the country by the US government through the World Food Programme, because it was genetically modified (GMO).

1. What is your view of Government's decision to reject GM maize donation?
2. In your opinion, was the decision justified?
3. What would be the way forward in handling GMOs in future?
4. As a Ministry of Science and Technology what should be done if GMOs were to be embraced?

Appendix III: Discussion guide for National Farmers Union

In 2002 at the height of Zambia's food shortages when people of Zambia in some communities were faced with starvation, the Zambian government rejected food aid in form of maize brought into the country by the US government through the World Food Programme, because it was genetically modified (GMO).

1. What is your view of Government's decision to reject GM maize donation?
2. In your opinion, was the decision justified?
3. What would be the way forward in handling GMOs in future?
4. As a Farmers' Organisation, what should be done if GMOs were to be embraced?

Appendix IV: Discussion guide for Zambia Agric. Research Institute-ZARI

In 2002 at the height of Zambia's food shortages when people of Zambia in some communities were faced with starvation, the Zambian government rejected food aid in form of maize brought into the country by the US government through the World Food Programme, because it was genetically modified (GMO).

1. What is your view of Government's decision to reject GM maize donation?
2. In your opinion, was the decision justified?
3. What would be the way forward in handling GMOs in future?
4. As a Research Institute, what do you think should be done if GMOs were to be embraced?
5. What are you putting in place to prevent GMO entry into the country

Appendix V: Discussion guide- National Institute for Scientific Research

In 2002 at the height of Zambia's food shortages when people of Zambia in some communities were faced with starvation, the Zambian government rejected food aid in form of maize brought into the country by the US government through the World Food Programme, because it was genetically modified (GMO).

1. What is your view of Government's decision to reject GM maize donation?
2. In your opinion, was the decision justified?
3. What would be the way forward in handling GMOs in future?
5. As a Research Institute, what do you think should be done if GMOs were to be embraced?
4. What measures are you putting in place to prevent GMO entry into the country?
5. How have you handled maize samples found with GMO contamination?

Appendix VI: Discussion guide- community workers, students, ordinary Zambians

In 2002 at the height of Zambia's food shortages when people of Zambia in some communities were faced with starvation, the Zambian government rejected food aid in form of maize brought into the country by the US government through the World Food Programme, because it was genetically modified (GMO).

1. What is your view of Government's decision to reject GM maize donation?
2. In your opinion, was the decision justified?
3. What do you understand about GMOs?
4. What would be the way forward in handling GMOs in future?