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***Viewpoint*:**

Is the European attitude to GM products suffocating African development?

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Abstract. Currently, parts of Southern Africa are experiencing the third major drought in five years. The previous two droughts greatly affected food production, resulting in food shortages, which necessitated the provision of food aid to the region by developed nations. However, some of the food aid included genetically modified (GM) crops, the supply of which triggered hostile reactions by southern African governments, and in one case resulted in food aid being withheld from people on the verge of starvation. This article will examine the background and reasons behind the condemnation of GM crops by southern African nations, and will consider whether the lack of support of agricultural biotechnology by European nations has contributed to this situation. Furthermore, the necessity of agricultural biotechnology in future African development will be considered.

Introduction

During the last decade a revolution has taken place in agriculture due to the introduction of genetically modified (GM) crops. Virtually non-existent in 1995, commercial GM crops are now planted on over one billion acres (Lamp 2005). This milestone was achieved by the rapid adoption of GM crops in some parts of the world, as growers noticed the benefits, including a reduction in pesticide use, a decline in crop losses to pests and in some cases subsequent increases in yield. As research progresses, it is likely that GM crops will offer many further benefits, not just to growers but also to consumers (Kagan 2003).

Despite the potential of this technology, the production of GM crops is not evenly distributed on a geographical level. Currently, 17 countries grow GM crops commercially (International Service for the Acquisition of Agri-biotech Applications 2004). As most GM crops to date have been developed in the United States, it is unsurprising that it is the world leader in GM crop production, accounting for over half of the total global GM crop production (International Service for the Acquisition of Agri-biotech Applications 2004). Other North and South American countries including Argentina, Canada and Brazil are also major GM crop producers.

However, the uptake of agricultural biotechnology has been particularly slow in other areas of the world, including the European Union and Africa. European Union (EU) countries are still reluctant to accept GM crops, as evidenced by deadlocks on the last 13 applications for EU approval of new GM crop varieties (Smith 2005). However, the need for agricultural biotechnology in the European Union is not nearly as great as in Africa. Yet, with the exception of South Africa, no other African nations have permitted the commercial production of GM crops, despite endemic food shortages that plague the continent. While the production of GM crops increases at a global level, if acceptance remains confined to the areas where the crops are currently grown, there is a risk that those who are most in need of this technology will be unable to derive its benefits.

The European Union and GM crops

The European Union was an initial supporter and an importer of GM crops and GM food products in the mid 1990s. However, European support for agricultural biotechnology did not last long. The European media began to focus on GM foods in 1998, with newspaper articles appearing about the then unpublished research of Dr Arpad Pusztai, a researcher at a Scottish research institute. Dr Puzstai's research concluded that consuming GM foods could be harmful to humans, based on his experiments on rats fed GM potatoes (Ewen and Pusztai 1999). These adverse effects were unable to be repeated, despite numerous attempts (Appell 2003). An independent analysis by scientists appointed by Britain's Royal Society criticised the research for being flawed and concluded that it

Abbreviation used: GM, genetically modified.

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was incapable of supporting the claimed results (The Royal Society 1999).

Nevertheless, the media seized this potential for controversy and intensively focused on questions of safety in relation to GM foods. Given the broad media coverage, along with the outbreaks of mad cow disease and foot and mouth disease, which had already raised the issue of food safety, the damage was done in the minds of European consumers. Bowing to consumer concern, the European Union instituted a *de-facto* moratorium on GM foods in September 1998 (Appell 2003) No new varieties of GM crops were allowed to be imported or grown in the EU and food products containing ingredients derived from these varieties were prohibited.

The consumer backlash against GM was so great that many supermarkets stopped carrying food products containing those GM ingredients that were approved before the start of the moratorium (Appell 2003). The EU denied the existence of a moratorium, but stated that no new GM crop varieties were being approved until a new system of regulation for GM crops and foods was complete. Finally, in July 2004, a new variety of GM sweet corn was approved for sale in the EU (Sparshott 2004). However, no approvals for the cultivation of new varieties of GM crops in the EU have been issued and no imports of other new GM crop varieties have been approved. Most recently, the EU has voted to maintain bans on varieties of GM maize and oilseed rape (Brown 2005).

The African reaction to GM crops

Most African nations have also been slow or unwilling to adopt agricultural biotechnology, with the notable exceptions of South Africa and more recently Kenya. South African farmers are commercially growing genetically modified glyphosate-resistant cotton, soybean and corn varieties. In Kenya open field trials of locally developed varieties of insect-resistant GM maize have begun. In addition, it has been announced that the Kenyan National Biotechnology Policy will be tabled in parliament in the near future (Karembu 2005). Adoption of the policy and successful trial results should pave the way for a regulatory framework for GM crops in Kenya. Table 1 summarises the status of such regulatory frameworks and the position of GM crops in sub-Saharan African nations, which are major exporters of agricultural products to the EU.

A large number of African countries remain skeptical and cautious of agricultural biotechnology, especially Zambia. Once a food exporter, Zambia is currently facing its third serious drought in the last five years (Zulu 2005). The lack of rain has resulted in a low production of corn, the country's staple crop and the sole food source for a large number of its citizens. Despite requiring an estimated 200 000 tons of maize to avoid mass starvation this year, Zambia refuses to accept food aid that may contain GM corn (Zulu 2005). The background and reasons for the Zambian government's reaction to GM crops will be examined, as they are at least partly indicative of the prevailing view about this issue among most governments in the region.

This stalemate surrounding Zambia's refusal to accept food aid containing genetically modified crops stems from 2002, when several southern African countries suffered the worst food shortages in over 10 years as a result of massive flooding followed by a sustained drought (Jones 2002). These natural disasters laid waste to the agricultural production of the region, which had already been weakened by civil unrest, mismanagement and a reduced labour force due to the AIDS epidemic (Krauss 2004). It was estimated that ~15 million people faced starvation. The international community reacted quickly in offering food aid to the affected countries. The problems began when the United States offered food aid, in the form of domestically grown crops (Laidlaw 2002).

Conventional rice and wheat were initially offered as food aid by the United States, but corn, the staple crop of much of southern Africa, was requested by the governments of Zambia, Zimbabwe, Mozambique and Malawi. The United States complied with this request and agreed to provide surplus USA corn to the region. However, at the time, more than one-third of the corn produced in the United States was genetically modified to confer herbicide resistance or pest resistance. Since a system of segregation between GM and non-GM crops does not exist in the United States, the food aid being provided contained GM corn.

This food aid was initially refused by the governments of Malawi, Mozambique, Zambia and Zimbabwe, which all claimed that the food aid was 'contaminated' with GM organisms and consequently that it was hazardous to human health (Krauss 2004). The president of Zambia, Levy Mwanawasa, went even further by denouncing GM crops as poison (BBC 2002). In the light of the dire humanitarian situation, the refusal of food aid on the basis that it may contain GM crop varieties that had been consumed by millions around the world for the better part of a decade, without any apparent negative effects, was considered unfathomable by many experts.

Mass starvation was avoided in Malawi, Mozambique and Zimbabwe by the acceptance of milled GM cereal crops from the United States (Krauss 2004). Milling, while expensive, ensured that the corn provided as food aid could only be consumed but not planted. This solution prevented mass starvation, while preserving the non-GM status of the three countries.

However, Zambia's government remained defiant even in the face of impending starvation and even refused milled corn as food aid because it contained GM corn varieties. A major human tragedy in Zambia was averted at the last possible moment by the provision of non-GM food aid by European Union countries (Krauss 2004). Only time will tell how the current food shortages will be addressed in Zambia

Table 1. Status of national regulatory regimes for genetically modified organisms and the position of GM crops in the top 12 sub-Saharan African exporters of plant-based agricultural products to the European Union

Sources of data: Cameroon, United Nations Environment Programme — Global environment facility project on development of the national biosafety framework for Cameroon (2003) Quarterly progress report: 1 January 2003–31 March 2003; Ghana, Madagascar, Namibia, Senegal, Sudan, Tanzania, Zimbabwe, African Centre for Biosafety (2005) GMOs in African agriculture — overview; Ethiopia, United Nations Environment Programme — Global environment facility project on development of national biosafety frameworks (2004) Ethiopia — National progress report submitted to the third series of subregional workshops; Tanzania, Balile D (2005) GM crop tests get green light in Tanzania. Science and Development Network, 28 February

Country	Status of regulatory regimes and GM crops
South Africa	South Africa has a regulatory system for GM organisms, established pursuant to the *Genetically Modified Organisms Act 1999*. This legislation regulates the approvals for the planting and import of GM crops. An executive council was formed from representatives of six government departments and is responsible for approving and monitoring the research and development of agricultural biotechnology in the country. GM cotton, soybean and maize varieties are commercially grown in South Africa.
Cameroon	Biosafety legislation encapsulating the precautionary principle has been drafted and tabled in parliament. A regulatory framework for GM crops is being developed but is not in place yet. Universities and organisations within Cameroon are currently carrying out research into GM crops, but no trials or commercial releases have yet taken place.
Ghana	There is currently no regulatory system in place, although draft regulations on biotechnology have been created. The chief government body responsible for agricultural biotechnology is the Ministry of Environment, Science and Technology. Research into GM crops is currently being undertaken, but no trials or commercial releases have taken place.
Kenya	It is anticipated that the Kenyan National Biotechnology Policy will be tabled in parliament in the near future. Under the proposed legislation, a national biosafety authority would be created which would decide on applications for activities involving genetically modified organisms. Field trials of locally developed insect-resistant GM maize are currently taking place in Kenya.
Madagascar	There is no regulatory regime for genetically modified organisms in place. No research, trials or commercial releases of GM crops have taken place.
Zimbabwe	Zimbabwe has implemented legislation pertaining to agricultural biotechnology and has a regulatory framework, which has been criticised for being unclear. In 2002, Zimbabwe initially rejected GM maize as food aid, but eventually accepted the maize, once it was milled.
Ethiopia	There is currently no regulatory framework. The Ethiopian Federal Environmental Protection Authority has established the Biosafety Secretariat Office, which is responsible for developing the national biosafety framework. There have been no trials of GM crops or commercial releases to date.
Senegal	Senegal does not have a regulatory system for genetically modified organisms. Research into GM crops is being undertaken in the country, although no trials or commercial of GM crops releases have taken place.
Sudan	Sudan does not have a regulatory regime for genetically modified organisms. No research or trials of GM crops have yet taken place in the country and no GM crops have been commercially released.
Tanzania	Tanzania does not have a regulatory system for GM organisms, but a national committee has been created to draft legislation for establishing such system. The Tanzanian government has announced that it anticipates beginning trials of insect resistant GM cotton in October 2005, even though it is currently illegal to grow GM crops in the country.
Namibia	Namibia's national biosafety policy was passed in 1999 incorporating guidelines from the European Union. A national biosafety committee was established to create the regulatory framework for genetically modified organisms. Draft legislation has been developed. Namibia accepted milled GM maize as food aid in 2000, but rejected it in 2002.
Zambia	Draft biosafety legislation that deals with genetically modified organisms has been created and is based on the precautionary principle. The import or planting of GM crops, even as food aid, is currently prohibited.

this year and in the future and whether certified non-GM food aid will be available, should the need arise.

Reasons for the African rejection of GM foods

Zambia has followed in Europe's footsteps in embracing the precautionary principle in its draft national biosafety legislation (Republic of Zambia 2004), which provides that GM crops should not be allowed, since their safety cannot be conclusively proven. There are a variety of reasons for Zambia's reluctance to accept any GM crops. Officially, the decision to not allow GM crops was made after consultations with foreign experts by a delegation of Zambian scientists in 2002, which determined that health and environmental concerns posed by GM crops outweighed the immediate need for food by the Zambian people (Lewanika 2003).

The delegation charged with obtaining advice about GM food aid from experts in the field visited various organisations throughout Europe and the United States, including Greenpeace, Friends of the Earth and several other groups that are fundamentally opposed to agricultural biotechnology (Wilson 2002). Amongst the organisations consulted was Farming and Livestock UK, which is reported to have told the delegation that the virus used in the creation of most GM crop varieties could form a retrovirus which in turn could cause symptoms similar to HIV (Wilson 2002). Given unsubstantiated and clearly misleading information such as this about health effects, it is unsurprising

that the delegation's report took a negative view of agricultural biotechnology.

The environmental impact particularly feared by the Zambian government was that seeds from GM corn food aid could be planted and could cross-pollinate with locally grown corn. If this happened, Zambia's corn could not be certified as being free of genetic modification. This was a concern because future Zambian agricultural exports to the European Union may have been adversely affected, due to the profoundly negative attitude to GM crops prevalent in Europe (Lewanika 2003). The leader of the Zambian government delegation on GM crops has stated that this was one of the factors that were considered when deciding whether to allow GM food aid (Lewanika 2003), although its importance in the decision was downplayed.

However, export figures suggest that preserving the European Union market for southern African countries' agricultural products may have been the primary factor affecting the decision not to accept GM food aid. Exports of agricultural commodities to the European Union account for significant revenue for southern African nations (Laidlaw 2002). In many African nations, agriculture is the second most important source of revenue, after mining (Action for Southern Africa 2002). With a continually decreasing amount of natural resources left to mine, agriculture is poised to become a more important source of revenue than ever for most African nations. Currently, horticultural exports are a vital export-earning sector for Malawi, Zambia, Zimbabwe and South Africa (Action for Southern Africa 2002). European markets are critical for Southern African farmers, as approximately half of the region's agricultural exports are purchased by the European Union (Action for Southern Africa 2002). Zambia's horticultural exports alone exceeded 5000 tonnes in 1997–1998 and 8400 tonnes the following year and contributed over $110 million to the country's economy over the two seasons (Action for Southern Africa 2002). Table 2 lists the top sub-Saharan African exporters of plant based agricultural products to the EU and the quantities exported.

In addition to horticulture, southern African countries produce various field crops, the predominant one being corn. In 2003, Zambia produced 1.1 million tonnes of corn, which was almost equal to the total amount produced in the preceding two years, during the drought (United Nations Food and Agriculture Organisation 2005). According to the United Nations Food and Agriculture Organisation (FAO) figures Zambia exported corn to the European Union in 2000 and 2002 (United Nations Food and Agriculture Organisation 2005), the latter instance being during the drought, when over three million people in the region were on the verge of starvation. This action in itself indicates a deep reliance on income from agricultural exports to the European Union.

Table 2. The top 12 sub-Saharan African nations, in terms of exports of cereals, fruits (including nuts) and vegetables (including roots and tubers) to the EU 15 countries during 2004
Source: EUROSTATS

Country	Total exports (tonnes)
South Africa	939 386
Cameroon	265 815
Ghana	75 300
Kenya	68 362
Madagascar	26 682
Zimbabwe	25 762
Ethiopia	24 723
Senegal	13 746
Sudan	8869
Tanzania	7138
Namibia	5930
Zambia	4888

Despite this reliance, Europe seems content to preserve the *status quo* of the situation. To this end, a molecular biology laboratory is being built in Zambia to detect GM organisms entering the country (Ngandwe 2005). Funds for the training of laboratory staff and equipment for the facility have been donated by the Norwegian government (Ngandwe 2005). While Norway is not a member of the EU, it is a member of the European common market, owing to its participation in the European Economic Community. Zambia's construction of a facility dedicated to the preventing the spread of GM food may set a dangerous precedent for other African countries and its partial funding by a European nation may be interpreted as a signal to continue the rejection of GM crops.

While some may see the choices made by the government of Zambia in this crisis as an exercise of its rights to preserve its GM-free status, such a view does not take into account the needs of the affected people facing starvation. Despite the Zambian government's assurances to the contrary, it is likely that the decision to reject GM food aid was made on the basis of negative and in some cases incorrect information about GM crops by activist organisations, combined with the fear that Europe's markets would close to its agricultural produce, should GM food aid be accepted. The activists who advised the Zambian government were all from developed nations and were unlikely to have had experienced food shortages, so were in no position to advise that possible, although unlikely, health risks should override the much more immediate need for food. Yet that is precisely what happened. Furthermore, the European Union's extremely slow approval of GM crops following the end of its unofficial moratorium is forcing African nations reliant on agricultural export earnings to reject agricultural biotechnology.

The current situation in Africa is another example of the third world needlessly suffering at the expense of the

first. Hopefully, the citizens of southern African nations, especially Zambia will not have to starve because of the irrational rejection of GM crops by the governments of these countries and also by the European Union. It is extremely likely that GM crops will eventually become necessary in Africa to provide enough food for its burgeoning population, which according to predictions is set to surge in the next half a century (United Nations Food and Agriculture Organisation 2004). As such the current policies on GM crops and food are unsustainable and will need to change in the near future.

World population growth and food production

Today the world's population is approaching 6.5 billion people. By 2035, estimates suggest the world's population will be around 8.4 billion people (United Nations Food and Agriculture Organisation 2003). Currently, 842 million people do not have enough to eat, while billions more suffer from micro-nutrient deficiencies, which is a form of malnutrition attributed to an inadequate diet (United Nations Food and Agriculture Organisation 2003). Unsurprisingly, most of these people live in developing countries.

It has long been argued that there is a global food surplus and that localised food shortages in some parts of the world are caused by unequal distribution of food between developed and developing nations. The unequal distribution argument would fail on a theoretical level as well as on a practical level, if the world had an extra two billion people, which is likely to be the case by the year 2030 (United Nations Food and Agriculture Organisation 2003). The FAO has predicted that global food production must increase by 60% to feed the projected population, in an era where the natural resources on which agriculture depends are rapidly becoming less abundant (United Nations Food and Agriculture Organisation 2003).

As many African countries are currently not producing enough food to feed their citizens and do not have the financial capacity to import food without relying on food aid, it is clear that there is a need to increase crop yields in order to feed a burgeoning populace. Currently, sub-Saharan Africa, with the exception of South Africa, produces less than 1730 kg of cereals per ha, while other developing nations such as India and China produce ~2470 kg and 5340 kg per ha, respectively (Sanchez 2004).

The reason for such a discrepancy between African nations and other developing countries is largely due to the fact that the Green Revolution, which boosted crop productivity and yield and thus, the amounts of available food in Asia and other parts of the world, did not make its way to Africa to any great extent (Sanchez 2004). Currently, the majority of African farmers are using outdated farming practices in nations where the infrastructure that supports farming is crumbling. In order to boost its yields and also become more internationally competitive in the agriculture sector, Africa is in dire need of greatly improved agricultural practices.

Genetically modified crops can play a part in the rejuvenation of African agriculture by improving agricultural productivity and thus increasing the availability of food. This could be achieved by the planting of high-yielding pest- and drought-resistant crops, in order to reduce the chance of crop failure, as well as by the development of crops with increased nutritional content, which could provide nutrients lacking in current African diets. A humanitarian program to develop golden rice, which is rice genetically modified to contain vitamin A, is already at an advanced stage, but is primarily focusing on rice-producing south and south-east Asian nations. In addition to nutrient enhancement, it is possible that in the near future crops could be developed to grow in poor soils, dry areas or in conditions where conventional crops could not successfully grow.

Nobel Prize winning crop scientist Dr Norman Borlaug, who has been hailed as the father of the Green Revolution, is a supporter of the use of biotechnology to increase food production in areas where malnutrition and starvation is rife (Borlaug 2000). Dr Borlaug has stated that through the use of biotechnology in food production, the world is capable of sustainably producing food for 10 billion people. Without agricultural biotechnology, further clearing of wilderness areas will be necessary in order to grow enough food to feed the growing population.

Despite their potentially great benefits, GM crops are only a part of the solution, because other factors necessary for advancement in agricultural practices, such as improved irrigation and fertilisation of soils will need to be addressed and implemented (Sanchez 2004). Education also needs to play a part, because to make the most of GM crops, a generation of African farmers would need to learn the techniques for growing these crops (Sanchez 2004). However, perhaps the biggest obstacle to the advancement of African agricultural practices, apart from the current opposition to GM crops by several African governments, is the apparent lack of interest in developing GM crops suited to the region.

Roles of private and public agricultural biotechnology organisations

A large proportion of the crops grown by subsistence farmers in Africa are the so-called orphan crops, such as sorghum, millet, cowpeas and teff (United Nations Food and Agriculture Organisation 2004). Orphan crops are outside the thirty common crops that provide the majority of human nutrition, and are under-utilised, under-developed and neglected, especially by the agricultural biotechnology industry, which is almost exclusively made up of private sector companies from developed nations. The industry is generally focused on developing new strains of commercially

viable crops for large, profitable markets, which excludes most developing nations. It is unlikely that the biotechnology industry will be rushing to develop GM crops suited to African conditions, as there is very little prospect of recouping the research and development costs. However, the development of golden rice demonstrates that potential exists for collaborations between the biotechnology industry, research institutions, universities and other bodies to develop GM crops tailored to disadvantaged people in developed countries. If golden rice proves to be a success, further collaborations of this nature are more likely to occur.

Additionally, there are international public bodies that develop agricultural technologies. The largest of these, the Consultative Group on International Agricultural Research (CGIAR), aims to achieve sustainable food security and reduce poverty in developing countries through research in agriculture and related fields (CGIAR 2004). While the CGIAR has developed several new crop varieties that are greatly benefiting poor farmers, its research and development budget is overshadowed by those of multinational biotechnology corporations. The top ten global bioscience companies spend almost US $3 billion on the research and development of agricultural biotechnology every year (Tenuta 2000). In 2003, CGIAR had a budget of US $381 million, not all of which was devoted to crop biotechnology (CGIAR 2004).

Conclusion

There is negative perception of agricultural biotechnology in Southern Africa, especially in Zambia. The reluctance to accept this technology, even in the form of food aid, despite over a decade of safe consumption of the same varieties, can be attributed to two major factors, namely fear and lack of knowledge. Given the general lack of knowledge about this topic amongst African governments, the fear of the unforeseen effects of GM crops was largely created by groups opposed to agricultural biotechnology, in order to steer these governments away from accepting GM food aid.

Second and more importantly, economic considerations were taken into account by African governments when deciding whether to accept food aid containing GM crops. The fear was that European Union markets for their agricultural products would be lost if the GM crops provided as food aid were planted and cross-pollinated with domestic corn crops. To prevent the possibility of planting, Malawi, Zimbabwe and Mozambique requested milled cereals to be provided.

Given the current scenario, it is possible that most southern African nations will not waver in their general opposition to GM crops and food until there is a real change in the attitude of the European Union and products of agricultural biotechnology become more widely accepted. Ultimately, the change to higher-yielding forms of agriculture, including GM crops, will become necessary on the African continent, if population growth estimates are to be believed. Not improving African agricultural practices in the short or medium term is likely to result in the destruction of further wilderness areas for farmland.

It is clear that the European Union's unwillingness to accept GM crops, even in the light of favourable scientific evidence, is having an impact on African development. It is impacting on the improvement of farming practices and restricting the availability of food aid to those suffering food shortages. This is unlikely to change until the EU fully accepts GM crops and an import market for GM produce is established. Given the increasing population and the constant destruction of wilderness areas for farming lands, it is imperative that new farming practices, including genetically modified crops are made available to African nations as soon as possible, in order to curb the cycle of malnutrition, starvation and ultimately, poverty.

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