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The Feasibility of Using Genetically Modified Sugarcane in Mozambique

Mozambique is one of the poorest countries in the world. Located in East Africa, it is a land of paradoxes. The land contains 25 rivers and borders the Ocean, yet transportation is a problem for the citizens. There are 784,090 sq km of land and 17,500 sq km of water available, yet “only 1,180 sq km of it is irrigated” (Mozambique). Only 5% of the land is arable, and still agriculture accounts for 81% of the jobs there. Even with a tropical climate that averages around 68 degrees Fahrenheit in the winter, Mozambique often receives bad harvests. The “upper plains are victim to long droughts, while the coast is often devastated by floods” (Means). Despite all these difficulties, “Mozambique has a great agricultural potential which is not tapped” (Seed Sector). The government of Mozambique is a multiparty republic; it’s relatively stable and will be easy to negotiate with. It also has a good reputation among other powerful countries such as the United States. Farmers grow crops such as cotton, cashew nuts, sugarcane, tea, cassava (tapioca), corn, and potatoes, many of which could be used for biofuels. Although only 5% of the land is arable, there is a work force of 9 million, more than enough to work at planting and harvesting crops. Certain issues, such as drought and lack of adequate transportation, do inhibit agricultural development in Mozambique. “Bad roads and unreliable transport make it expensive to move food and seeds” (From). Due to natural disasters, people in Mozambique and other African countries have been facing severe food crisis. Farmers have small plots of land with little irrigation and their livelihood is often dependent upon the weather. One would think that being close to rivers and oceans would provide adequate transport of goods in Mozambique, but lack of reliable transportation and weather makes life for farmers very strenuous. The U.S. Government Accountability Office has been studying and researching this issue and suggests that GMO, or genetically modified organisms, be “used in order to change the crops and make them more adaptable to the weather” (Foreign). Another organization called Crocevia, along with the help of the Bank of Mozambique, once provided funding for farmers and created new seeds that gave high yields without requiring fertilizers. The seeds of corn, peas, and other plants became locally available, “eliminating the need to turn to international seed suppliers and to use chemical fertilizers” (Mozambican Farmers). This is significant information because it shows that the farmers of Mozambique once used genetically modified seeds to get better yield of crops. After the more recent droughts and natural disasters, new seeds are needed. However, knowing that GMOs have already been successfully introduced and used in Mozambique will make it easier to use this method to help crop farmers once more. The large number of rivers means that developing adequate irrigation won’t be too complicated, and transportation of products in and out of the country can be done via water. Also, the effects of natural disasters can be dealt with through better education and preparation for native Mozambicans.

Most Mozambicans live in the countryside, and their lives are dire. There are few rural roads, and therefore few shops. “The 60% or so of schools destroyed or closed during the war have almost all been rebuilt or reopened, but over half adult population remains illiterate, and 80% languish in deep poverty” (Better Times). There is “a lack of trained teachers and poor enforcement of school attendance” (Means). The nation’s only university is the Eduardo Mondlane University in Maputo. Life expectancy is low, estimated at 40 years for women and 39 years for men. Mozambique is ranked 171st on the United Nations Human Development Index, which measures quality of life indicators. “Over 1 million active landmines left over from the civil war pose serious health and safety threats”, and many farmers and their families still step on land mines left over from the civil war while gathering firewood (Means). Much of the people’s local diet is based upon what they themselves grow on farms, such as cashews, corn, potatoes, and coconuts. Agricultural wages are much lower than industrial ones. The minimum wage in agriculture “currently stands at 459,222 meticaïs (about 19 dollars) a month” (Minimum Wage).

In Mozambique, “people’s daily survival depended on subsistence farming” (B.J.A.G.). About “3.04 million peasant families” farm in Mozambique, all of them cultivating “a total of less than 60,000 hectares and refurbished agro-industrial units growing 30,000 hectares of sugar-cane” (Robinson). Farming is one of the few ways that the people of Mozambique obtain food, and it is an important source of income for 75% of the 20 million inhabitants. The average farm family holds 1.2 hectares of land and practices a “manually cultivated bush fallow system, the intensity of which varies with the population pressure” (Robinson). Agricultural practices in Mozambique are predominantly traditional, so land is prepared with a cutlass and fire, and the African hoe is used to cultivate it. If lucky, peasant farmers may hire an ox-driven plough, or even a tractor, to cultivate their land, although this is reserved for the wealthiest of citizens. Peasant farmers grow a number of crops, one of the more important ones being tree crops, which provides an important source of foreign exchange earnings each year and brings in limited money to the household. Coconuts and cashews are widely grown along the coastline, and other major cash crops include tobacco, cotton, oilseeds, tea, citrus, and tomatoes. These crops “offer alternative sources of revenue to the small farmers in the interior districts, where coconuts and cashews are not grown” (Robinson). The major staples are maize, cassava, sorghum, beans, groundnuts, millet, and rice. Cassava and sweet potato growth is being encouraged in drought-prone areas by the government, where “communities in the interior whose food security was regularly threatened by insufficient or untimely rains are already appreciating the [results]” (Robinson). Sugar cane is a huge part of the Mozambican economy; 30,000 hectares of industrial plantations are grown at four operational sites surrounding sugar mills in Maputo and Sofala. “Sugar cane production has risen from 386,000 tonnes (1998) to 2.22 million tonnes (2004) due to improved organization and production practices” (Robinson). Agricultural inputs such as improved seeds, fertilizers, and pesticides is limited to a small number of modern farm enterprises that grow cash crops or crops on contract, meaning that they are largely unavailable to the average peasant farmer. Marketing techniques are also limited, as peasant farmers can only sell to each other in the marketplaces, provided that they can find the necessary transportation to cart their goods there. Livestock production is rare, and so the food security of Mozambique depends largely upon agriculture and the success of its subsistence farmers.

The major barriers to improving agricultural productivity and farm income are based upon the availability of tools that farmers need to produce goods (meaning access to labor, the animals needed to use tools, and the availability of good seed), the unpredictable weather changes, the transportation available that can take goods to be sold at markets, and pests and diseases. “Ninety-six percent of field crops come from family farms of 1 to 3 hectares that are mostly hand-cultivated with animal traction” (Robinson). Each household usually plants crops based upon their own household demand for consumption. In order to obtain seeds, “the usual approach is to borrow or work for seed from neighbors” (Robinson). “Mozambique loses about 77 million US dollars a year due to the inability of the national seed system to catalogue the existing seed crops. During 2000-2001, 95% of the seeds of the country were purchased elsewhere in southern Africa instead of being produced in Mozambique” (Seed Sector). The Food and Agriculture Organization of the United Nations and many other agencies, organized seed fairs during 2003-2004 to provide many different types of seeds to families for free. Other “agricultural fairs are being promoted across the country, where peasants can acquire tools such as hoes, machetes, and axes” (Mozambique Grain). These fairs are necessary because farmers in Mozambique have almost nonexistent access to credit, as no formal credit institutions exist in the rural areas, so most are dependent on their own self-guided education concerning the planting and harvesting of crops. Farmers also use seeds from the previous season’s production or from local informal sources, with the advantages that these seed strains are available locally, have well understood characteristics, and are relatively cheap. However, the actual effectiveness of these seeds is not optimal. Many factors must be taken into account when dealing with the growth of seeds, such as the quantity of rainfall, soil fertility, timing of sowing and harvesting, weeding practices, and pest and disease control. Sometimes deliveries from seed companies

are delayed, which may cause planters to miss the planting season and ruin their harvest for the entire year. Of course, the overall effectiveness of farming is all based upon the enthusiasm with which peasant farmers take planting and how much effort each household puts into their land.

“In the past few years, the rainfall pattern has been irregular and unpredictable both within and between provinces” (Robinson). This unpredictable rainfall interferes with weeding or may encourage pest and disease infestations. “The temporal and spatial distributions of rainfall are critical to crop performance, resulting in wide-ranging fluctuations in annual crop harvests from year to year” (Robinson). Almost “198,000 hectares of farm land in Mozambique suffered great loss during last April’s devastating floods [in 2000]. Crops [were] reduced by the late start of the rainy season, irregular distribution of rainfall, and heavy droughts” (Crop Loss). Without access to reliable information about the weather, most Mozambicans must rely on their own intuition in deciding when to work on their fields and how to go about it. Delays in harvesting time not only delay the ability for farmers to receive money for their goods, but also increase the hunger gap. The most dangerous pests in Mozambique affect the cassava, cashew, groundnuts, and beans. In some regions, large wild animals like elephants, pigs, and monkeys are a huge threat to the crops, and “a 24 hour guard needs to be placed on the fields to protect the crops at all stages of growth” (Robinson). These jobs place a huge strain on the availability of household labor as it removes a readily available pair of hands from the field into being a watcher.

In order to help Mozambique recover from its economic slump and fight poverty, more research must be conducted into crop biology and agronomic technologies for improving yields, disease and drought resistance, and sustainable agricultural systems. This research will pertain to a future in growing crops for biofuels. In other words: what scientific improvements can be made to increase the productivity and health of crops that farmers in Mozambique grow, and which can be used in biofuels production? The country is currently “considering investing in a massive bio-fuels program to cut oil imports and supply its growing manufacturing and tourism sectors with low-cost energy” (Mozambique Eyes). According to the Science and Technology Minister Venancio Massingue, Mozambique has the potential to produce more than 21 million liters of ethanol and 40 million liters of bio-diesel. “Imports of refined oil products cost Mozambique dearly,” Massingue said. “Bio-fuels can turn this situation around.” “Producing GM crops for non-food purposes, as a renewable source of alternative fuels, may also provide the basis for a more rational and balanced consideration of the technology and its potential benefit, away from the disproportionate hysteria, which has so often accompanied the debate over GM foods,” the Agriculture Biotechnology Council declared in 2007 (Mayet). The use of genetically modified sugarcane in relation to biofuels could be a solution to the hunger and economic hardships in Mozambique.

Sugarcane is one of the staple crops of Mozambique. “Under the European Union’s African, Caribbean and Pacific (ACP) Sugar Protocol, Mozambican producers are guaranteed a price of 632 a tonne for their sugar, making the sector viable” (Ford). In 2006, “the government of Mozambique announced that it plans to invest \$14 million in a biofuel factory in the Maputo province and is preparing another unit for export to the European Union” (Mozambican Government). The ethanol distillery will process sugar cane, which can then be used for biofuels. The state oil company Petromoc and an agricultural cooperative called Cofamosa also announced they would invest \$125 million on an industrial unit to manufacture biodiesel from sugar cane in Moamba district. As of 2007, Petromoc unveiled a new “\$550 million bio-fuels project aimed at easing [the] energy crunch” in Mozambique (Mangwiro). These new factories would make it possible to, “reduce the use of convertible currency on importing gasoline, helping to mitigate the loss of income from exports resulting from the fall in sugar prices in the European Union, as well as reducing carbon emissions” (Mozambican Government). “Replacing oil with sugarcane would reduce the use of non-renewable resources for chemicals by up to 90 percent” (Australia). All of these new buildings are part of the government’s efforts to diversify its sources of income and reduce its dependence on oil imports. In addition, they will also “create about 800 jobs and lead to a maximum annual production of 226 million liters of ethanol and bio-diesel seven years after start-up” (Mangwiro).

An example of successful biofuels in action can be found in Brazil, the world leader in ethanol production, whose products account for “37% of the global [ethanol] market” (Mayet). Biofuels have boosted the Brazilian economy greatly. Brazil has been conducting extensive testing of genetically modified sugarcane, trying to obtain GM plants that “have been modified to exhibit sucrose levels 15 % higher than those of ordinary sugar cane” (Brazilian). They have established one of the most comprehensive databases integrating genome sequences for sugarcane, and researchers there have “found and patented 200 target genes related to the accumulation of saccharose in the plant” (Brazilian). They are even working on developing a new strain of sugarcane which is resistant to drought, which would be hugely beneficial to farmers in Mozambique who battle drought problems yearly. In India, “scientists at the Sugarcane Breeding Institute have developed transgenic varieties, which are resistant to the dreaded red-rot disease and borer pests” (Indian). Indian scientists are hoping to produce strains of sugarcane that are pest and disease resistant, and with these new GM sugarcane crops “to produce at least 400 million tonnes by the year 2020 as against the present 300 million tones” (Indian).

The problem with genetically modified crops is that most of the world is afraid of them. Countries worry that these new crops will cause health problems in the future, or that they will destroy the natural biodiversity of the country. South Africa is the only African country that is commercially producing GM crops. “Mozambique raised concerns about accepting GM maize aid on biosafety and human health grounds and opted to ban its import.” (Miller). However, many major countries such as Brazil, China, South Africa, and the United States, have joined in the biofuel bonanza, and it stands to wonder why Africa won’t embrace the new technology. If it continues to reject genetically modified crops that could help their people greatly, then “it won’t gain a dime from the biofuel gravy train. Some would argue that Africa, traditionally accustomed to chronic food shortages, can’t afford the luxury of biofuels” (How). “Millions of people in the world eat genetically modified foods every day” (Michael). Yet at the same time, Mozambicans have been suffering in devastating famines. A recent report from the World Health Organization estimates that in Africa “nearly 14 million people, including 2.3 million children under the age of 5, are at risk of starvation” (Michael). The Mozambican government has asked that “GM seeds be milled before distribution to prevent their cross-breeding with local flora” (Michael). Many farmers are afraid that they’ll lose their spot in the European market if they cannot distinguish between natural crops and GM crops, and they also worry that biotech companies could “introduce a ‘terminator’ gene in their seeds, which would prevent small farmers from replanting them after harvest, making farmers dependent on big companies that control the price of seeds.” (Michael). These problems can be easily avoided if the Mozambican government is cautious in carefully regulating the GM industry in their country, and if they move their markets to countries that not only accept GM foods, but actively work to research and improve upon them. “Africa needs all the food that they can get – and fast. [Mozambique] cannot afford the luxury of engaging into debate and delay... GM foods might avert further famine while also protecting the environment by reducing the need for pesticides and herbicides” (Michael). By preventing the peasants of Mozambique access to genetically modified food, the government is preventing citizens from getting enough food to eat. Starving people are concerned with their everyday survival, not about debating the morality of altering the plant genome.

Biofuels have already been stringently tested, and as long as the government and researchers continue to regulate them, they should not degrade the environment. In fact, crops can be modified so as to improve the soil they grow in, possibly improving the environment instead. The situation in Mozambique is very severe: people are dying everyday from a lack of food and proper income. By implementing genetically modified sugarcane, the people of Mozambique will be offered more jobs, can earn more money, and can support themselves and their households. The country itself would gain a new export and a new hold in the rapidly growing biofuels market, and would reduce its dependence on oil. It’s a win-win situation for everybody in Mozambique. The potentials with biofuels are endless, and chances are they would greatly improve the lot of the average farmer. The average woman would also

benefit from biofuels, as her family would become more economically stable and she will become more confident in her ability to care for herself and others. Today “the Mozambican woman enjoys 85% of her rights” (B.J.A.G.). Hopefully with increasing stability in the country, the Mozambican woman’s life will improve as well.

“Development is like a tree, it must be grown from below upwards, it cannot be imposed from above... it can only fully survive and fully grow if it has been selected to suit the local condition, the local atmosphere” (Bhasin). Like Bhasin said, the situation in Mozambique can only be improved if the people are directly involved in improving their country. “Intervention in the economy with a view to consolidating power and sovereignty has been the central government’s goal ever since Mozambique acquired its name” (Joao). This can no longer continue. The government can regulate how and what farmers should produce, but they should do it with the personal benefit of the people and the population in mind. “No due consideration of rural communities and their livelihoods has left many potentially affected people uninformed and vulnerable to the risks associated with new developments” (The World). Mozambicans must be educated about biofuels and the new sugarcane crops and factories that will be improving their lives. “Lack of information is the greatest enemy of any country” (B.J.A.G.). In Mozambique, where the literacy rate are very low, the “most effective methods of learning are through story telling, songs and dramas. Daily survival depends on local resources and ingenuity” (B.J.A.G.). Mozambique needs people who care about their personal lives and can help them to recover from poverty through examples and relating to their way of life. “Interpersonal relationships take precedence over everything, including time” (B.J.A.G.). The Mozambicans are resilient people; they can learn quickly and better themselves if they are given the chance.

Consumers International, a worldwide federation of consumer organizations with 38 member organizations in about 22 African countries, has played an important role in shaping the debates around GM foods. “It advocates a legal regime in which all GM foods are subject to rigorous, independent safety testing, labeling and traceability requirements, and in which producers are held liable for the environmental or health damage which their products may cause. There is growing acceptance of this approach globally” (Miller). If Consumers International and the Mozambican government combine to regulate the GM sugarcane and educate the people about them, then Mozambique can begin to implement GM sugarcane very soon. The European Union (EU) has had a history of aiding the government of Mozambique with funds, and will probably continue this trend until Mozambique is financially stable. In 2002, the EU “EU disbursed 5 million euros (about 4.4 million US dollars) intended to support the 2002 budget of Mozambique’s National Agricultural Development Program” (European). For 2004-2006, it “offered Mozambique 48 million euros (about 57.6 million US dollars) to support its agricultural sector. 7.5 million euros will be spent on food security projects” (EU). “High-input technologies can be successfully introduced through well-funded high-profile programs” (Julie). With the backing of Consumers International, the European Union, and the national government, the people of Mozambique will be in good hands. As the excitement over biofuels technology grows, the average Mozambican subsistence family farmer can improve his lot by growing genetically modified sugarcane that will be pest and drought resistant and eventually be made into ethanol. As the country gradually improves economically, other factors will follow, such as better infrastructure and transportation, more viable irrigation systems, and a better life for the average citizen.

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