

Nathan Malkin, Student Participant
Upper Arlington High School
Columbus, Ohio

The Feasibility of the Adoption of Genetically Modified Crops in Cameroon

Background

The nation of Cameroon, lying several degrees north of the equator on the West African coast, has been extolled by some as “Africa in Miniature” (Summit Communications). Roughly the size of California, its territory measures 184,000 square miles (U.S. State Department) and includes a variety of diverse climate zones and ecosystems, including arid deserts, humid rainforests, and mountains capped by Mount Cameroon, Western Africa's highest peak (Encyclopedia Britannica).

As diverse ethnically as it is geographically, the country is currently home to over 18 million inhabitants (The World Factbook), who represent “more than two hundred ethnic groups” (Kummer 82). The Republic of Cameroon – the present-day union of these various groups – was formed in 1961 after the independence and subsequent reunification of the French and British Cameroons, mandates set up after Germany's loss of the colony in World War I (“History of Cameroon”).

Of the country's 18 million citizens, 6.674 million, or about 37%, are considered part of the active labor force (World Guide). Significant portions of the population work in the service and manufacturing industries, but an overwhelming majority of the populace is employed in agriculture: their proportion is estimated to be between 70% (World Guide) and 75% (World Book). Unlike many more industrialized nations, where farming is the domain of large land-holding enterprises, in Cameroon, “small family holdings are responsible for about 80 percent of the agricultural exports” (Encyclopaedia Britannica). It can thus be seen that one of the largest distinct groups in the Cameroonian population are farming families with their own small land holdings.

As in many African countries, poverty and unemployment are among the main issues facing Cameroon's government: 40% of its citizens were living in poverty in 2001 (“Rural poverty in Cameroon”) and 30% were unemployed (The World Factbook). However, “in Cameroon, poverty is fundamentally a rural phenomenon” (“Rural poverty in Cameroon”), with a survey showing that 49.9% of the poor live in rural areas (“Rural poverty in Cameroon”). Despite a variety of government- and UN-sponsored programs, such as the Poverty Reduction and Growth Facility Program, most of the rural poor must rely on themselves or their families – and the small plots of land that they cultivate – to provide food and sustenance. Thus, for many, farming is largely an issue of survival, leading to the prevalence of subsistence agriculture.

The family of a typical subsistence farmer in Cameroon shares many characteristics with its counterparts in other African countries. A typical couple may have four or five children (The World Factbook) and live in a small individual house or hut. Due to the varied climate zones and ethnic traditions, the building materials and construction types may be considerably different in various parts of the country. Some families may live in traditional mud or clay huts with thatched roofs made of palm trees (Kummer 124); others' homes may be constructed from bricks or concrete, with tin roofs. Even in farming communities, houses stand as “part of family compounds” (Kummer 125), which themselves are organized into villages or small towns; a “majority of the rural people” (World Book) may live in such villages, while still cultivating their own plot of land.

Though it is sometimes limited and, like many other things, varies by region, there is a general availability of schooling for Cameroon's citizens. The country's literacy rate, at 67.9% ("The World Factbook") shows that a majority of the population exercises this option. The same statistic also provides evidence of the still strongly held traditional views on the role of women in the household: the literacy rate of women is over 15% lower than that of men. On the other hand, studies have shown that, contrary to trends in other parts of the world, women with more education rear more children (Ware). However, a rather limited amount of career options means that, even after receiving an education, most people return to farming; in fact, this is encouraged by the government (Encyclopaedia Britannica).

Despite the shortcomings of the country's educational system and other elements of government and infrastructure, it is an important consideration that, when compared with many other African nations, Cameroon fares reasonably well. For example, though its life expectancy is about 53 years, the life expectancies of Nigeria and Zambia are 47 and 39, respectively ("Life expectancy at birth"). Additionally, though there are numerous allegations of officials' corruption and the government's sometimes undemocratic actions, Cameroon has enjoyed, since its independence, a large degree of political and social stability. These characteristics are particularly important when considering the implementation of sweeping new policies. In an absence of wars, humanitarian crises, or other similarly pressing issues, both the government and the people may be able to better focus on the implementation of agricultural techniques and ideas that may improve the standard of living.

Due to the population's reliance on farming, the nation is generally self-sufficient agriculturally (Encyclopaedia Britannica). Nevertheless, the currently unfolding food crisis is liable to affect Cameroon no less than other relatively poor countries of the world. As the country is dependent on agriculture for at least 70% of its revenue (Embassy of the Republic of Cameroon), the volatility of today's food markets is likely to have severe repercussions for the economy of Cameroon, significantly affecting the farming families who sell a modest excess of food to keep afloat. Unfortunately, most of the factors affecting the food crisis are beyond the control of Cameroon and its people. Food consumption rates, changes in crop allocation, and limited access to credit all affect the international agricultural economy but cannot be fixed (or, indeed, affected) by the country's policy. Instead, Cameroon would do well to prevent or alleviate the consequences of the food crisis by focusing on improvements to the nation's domestic agricultural policy. One such improvement is the advancement of the use of genetically modified crops among the country's farmers.

GM Crops and Why Africa Needs Them

The farming methods used by Cameroon's subsistence farmers have been virtually unchanged in centuries; similarly, families have cultivated many of the same crops for generations. Therefore, a switch to genetically modified crops (or even the encouragement of such a switch) presents not only logistical, but also social, challenges. Before it is undertaken, it is important, therefore, to consider why such a switch would be beneficial, which crops specifically could be replaced with their genetically engineered alternatives, and how the adoption process would be handled.

Since an antibiotic-resistant tobacco plant became the first genetically modified crop in 1983 ("GM Foods"), the debate over genetically modified organisms (GMOs), and particularly GM food crops, has been raging in all corners of the world. Critics warn about unknown and untestable effects of bioengineered foods on humans, and potentially hurtful effects on other species. They also bring up the important, yet unresolved, issue of bio-corporation monopoly and question the idea of treating forms of life as intellectual property. Supporters argue that no GM plant has yet been proven unsafe, and that the future of food sustainability depends on these crops. They cite the impending population crisis as

evidence.

Aside from the current food affordability crisis, there are additional, also significant, challenges that are facing the planet's food supply, primarily caused by the current population growth. Already, many countries in Africa and around the world are experiencing famine due to large populations competing for scarce resources. Yet worldwide population growth continues at a rate of 1.188% – over seven million people – annually (“World”). Food production must keep pace with the population growth in order to be able to, in the words of Norman Borlaug, “feed the population of 8.3 billion people that will exist in the world in 2025” (Pence). Given the almost-inevitable growth, how big a population the planet can actually sustain has been an unresolved question for demographers since Thomas Malthus.

Africa is the region most affected by the problem of over-population. “Within ten years, Africa will be home to three-fourths of the world's hungry people” (Gay 59). Yet, 70% of Africans are full-time farmers! Why are they unable to sustain themselves? Why is the region's agricultural production so poor? Some of the reasons for this are ecological. “Poor soil, harsh ecological conditions, poor infrastructure for transport of, and access to, food and declining investment in agricultural science” all contribute to the low efficiency of Africa's agriculture (Thompson xiv).

The problems are augmented by a general lack of resources on both an individual and a country-wide scale. In Cameroon and many other countries, the infrastructure is underdeveloped and transportation is limited to dirt roads and small private vehicles. Most of the continent's subsistence farmers grow their crops with little or no fertilizer, and pesticide use is also very rare. There is often not enough water. Scarcity affects almost everything, a concept clearly illustrated in Cameroon: as mentioned above, 70% of the population farms, but only 12.54% of the country's land is considered arable (Intute Consortium). Thus, land itself becomes a scarce and valuable resource.

However, many of these problems can be counteracted by the use of GM crops. Plants have been engineered to require less water, or no fertilizer. Other species have had their yield improved, to compensate for poor soil. And for over a decade, Americans have been eating bioengineered corn, which, during the growth stage, acts as its own pesticide. In short, genetically modified crops have the ability to alleviate many of the factors tying Africans to subsistence agriculture.

Cameroon's Crops and their GM Potential

Since a total re-education of farmers is hugely impractical, it is best to consider only those genetically modified crops whose 'unmodified' versions are already being grown.

The species being cultivated vary depending on the region of the country. “The main subsistence crops include plantain, beans, potatoes, yams, cassava, corn (maize), and oil palm in the south and peanuts (groundnuts), millet, and cassava in the north” (Encyclopaedia Britannica). Other crops, grown mainly for export, include cocoa and coffee (InfoPlease.com). Researchers have already engineered beneficial versions of many of these plants.

As seen from the list above, cassava is one of the food plants that can be grown fairly easily in several of Cameroon's varied environments. Cassava, a woody shrub, is somewhat reminiscent of yams or potatoes and is similarly grown for its starchy roots, “which contain nearly the maximum theoretical concentration of starch ... among food crops” (O'Hair). Due to its high carbohydrate content, the plant has become a staple crop in many African countries and made its way into the diets of “more than half a billion people” (“Cassava: a staple crop for millions”). Furthermore, cassava is a good crop to grow from

the perspective of a subsistence farmer, since it does not require much water or fertilizer and can grow in poor soil (“Cassava: a staple crop for millions”). In recent years, researchers working with cassava have found ways to add additional benefits to the plant through bioengineering. Richard Sayre and his team of scientists at the Ohio State University have created a version of the cassava that has “dramatically bigger roots” (Sawahel). Subsistence farmers would find the increase in root size, as well as leaf material, beneficial, since an equal land investment would yield a larger harvest. Another genetic modification helps farmers in a different way: researchers at the Swiss Federal Institute of Technology in Zurich have engineered the plant to resist the cassava mosaic virus. “In parts of East and Central Africa, epidemics of the disease can lead to total losses of harvests” (Sawahel), so a timely adoption of this 'breed' of cassava can avoid similar occurrences in Cameroon.

Corn and potatoes are also important crops for subsistence farmers in Cameroon. They are, however, similarly important (though on an entirely different scale) to the agriculture of the United States, where they have undergone extensive studies and genetic modifications. The most prominent kind of modification that both plants have received is bioengineered pest resistance through the addition of the Bt gene. The desired results are achieved by introducing a gene from “a naturally occurring soil bacterium, *Bacillus thuringiensis*” (Bessin) into the corn or potato plant. The gene produces a protein that is non-toxic to most organisms (including humans), but “kills Lepidoptera larvae, in particular, European corn borer” (Bessin). The protein has also been shown to be effective in combating the Colorado potato beetle (Feldman). Bt corn provides an example of other obstacles that need to be overcome for GMOs to spread: though the crop is widely used in the United States, and studies have confirmed its safety, “South Africa is the only country in Africa to approve the commercial planting of Bt corn” (Prakash).

Some crops, though still cultivated by subsistence-level farmers, may be intended for export, rather than sustenance. One example of this is cotton, of which 160,000 tons were produced in the past season. However, according to the general manager of Cameroon's national cotton company, “cotton is no longer regarded as profitable enough, and does not get the same attention as before” (Musa). If farmers were to switch to Bt cotton (engineered in a way similar to the Bt corn and potatoes above), perhaps this field would again become profitable.

In Cameroon's agriculture, the other major export crops are coffee and cocoa, with the country being “the world's fifth largest producer” of the latter (Encyclopaedia Britannica). Both plants have undergone research and successful genetic modification, but neither is quite ready for commercial use. Perhaps after the completion of laboratory and field testing, the fungal-, virus-, and insect-resistant cocoa plants (“Cocoa”), and uniform-ripening, de-caffeinated coffee trees (“GM coffee: brewing up a storm?”) will be made commercially available.

Similarly, genetically engineered alternatives exist for many other crops cultivated by Cameroonian subsistence farmers. Their specific characteristics and improvements vary, but each improves the individual farmer's total productivity in its own way. Particularly for the rural poor, even small improvements in efficiency can have a significantly positive effect on the food security of the family and the community at large.

Adopting GM Crops

GM crops are now widely available to interested commercial buyers; many more are being developed in laboratories around the world. However, the most challenging task in improving the food security of subsistence farmers through genetically modified crops is inducing the adoption of the new biotechnology. There are several reasons for this.

Most genetically engineered organisms are the intellectual property of large biotechnology corporations (e.g., The Monsanto Company). Though they are likely willing to expand into new markets, they will also be held back by the low buying potential and practically non-existent credit options of subsistence farmers. Distribution will also pose problems, since, even in Cameroon, “most...roads are unpaved” (World Book).

Most significant, however, is the resistance to GM crops from within African countries. Though there is no credible information about the opinion of Cameroon's president, Paul Biya, on GMOs, the actions of other countries in the region have established a clear precedent. Most African nations have been either indifferent or hostile to efforts to bring in GM crops. Indeed, Zambia even rejected foreign aid of genetically modified grain during a time of famine, with its president referring to it as “poison” (“Famine-hit Zambia rejects GM food aid”). Reasons for rejection of GMOs span from cultural and tradition-based to economic: for example, some African nations fear that if GM crops entered the food supply, they would “jeopardize exports to Europe, where GM food is less common [and less accepted] than in the United States” (“Famine-hit Zambia rejects GM food aid”).

There is evidence that, within Cameroon, there is a similar distrust of GMOs. A statement published by a government-organized “National Workshop by Civil Society on Genetically Modified Organisms” declares, “GMO pose a real danger to people’s health and the environment as well as to the socio-economic balance of our country” and urges “to officially forbid the production, importation and marketing of GMO in Cameroon until these products have proven to be harmless” (“Final Statement”).

Given the antipathy of society as a whole towards GMOs, simply importing GMOs and attempting to sell them (or give them away) is not likely to work. Instead, international organizations (and interested private corporations) may first attempt small-scale educational initiatives; these could also help in proving the GMOs to be harmless, as requested by the ‘Civil Society.’ An effective way to convince the farmers to adopt the new biotechnologies could be giving the GM crops to a few willing individuals. A South African woman was quoted at the Congress of Racial Equality: “We were struggling to keep hunger out of our houses. Now the future looks good. If someone came and said we should stop using the new maize, I would cry” (Gay 60). If the willing recipients have similarly positive experiences, the example of their successes, and word of mouth, may help improve the public perception of GMOs.

Working on a larger scale, the United Nations and other powerful international organizations, such as the World Bank, may attempt a top-down approach by opening dialogue on this issue with the government of Cameroon. However, the success of such a method is dubious, since the majority of UN member-states share in at least some of the distrust of genetically modified organisms. They could, however, work with the government to alleviate some of the concerns associated with GM crops.

Instead, large international NGOs (specifically, those with big endowments) should attempt to overcome another significant obstacle in the adoption of genetically engineered crops: the relatively high price associated with commercial GMOs. Cameroon's GDP per capita is only \$2,100 (“The World Factbook”), but poverty-stricken subsistence farmers have an even smaller income. Contributing to the problem is the fact that the offspring of many, though not all, commercial GM products have progressively lower returns, resulting in the need to purchase new seeds every year (Thompson xv). As a solution, international relief organizations may choose to initially subsidize GM crop purchases, until increased productivity, and the resulting profits, allow the farmers to purchase their own crops. As an alternative, money may be allocated to fund non-commercial GMOs. The best known precedent of this is the beta-carotene-enhanced Golden Rice, developed for the Rockefeller Foundation (Pence 157). The

same organization is now “supporting research into GM open-pollinated varieties that would be reasonably available to small-scale farmers” (Thompson xvii). Open-pollinated GMOs would not require yearly seed purchases and could thus be the solution to the economic barrier for GMOs in Cameroon and other African countries.

Conclusion

Ultimately, it will not be the United Nations, or NGOs, or international governments, but rather the farmers of Cameroon who will decide whether or not to adopt genetically modified crops. If we truly want them to succeed at achieving food security and weathering the current crisis, we must provide them with all the necessary resources, but then step away and allow the families to make their own decisions.

Subsistence farmers in Cameroon have much to gain from adopting genetically modified crops. Depending on the crop, this may be a higher yield, a better product, or more surviving plants – regardless, all contribute to an increase in productivity. And it is precisely this increase in productivity that will help families avoid hunger among the increasing population and the food crisis, and perhaps even provide the impetus to lift themselves out of the poverty associated with subsistence farming.

Yet we must also be mindful of the fact that many – not just in Cameroon, but around the world – are, for a variety of reasons, cautious of genetically engineered organisms. The adoption of GM crops must not be forced – the most we can do is help people understand that, in some cases, they are, in fact, the optimal solution.

In time, if these efforts achieve success, the quality of life of the people of Cameroon is likely to improve. Furthermore, the varied landscapes and ecosystems of Cameroon may serve as proving grounds for the newly developed crops and farming practices. And if Cameroon really is “Africa in Miniature,” perhaps we can learn from our experiences there and adopt the new insights and techniques to the continent as a whole.

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