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Kenya, Factor 5: Climate Volatility

## **Using GMOs to Alleviate the Negative Impacts of Climate Volatility on Kenya's Food Production**

### **Introduction**

Climate volatility adversely affects the food production of many nations. One such nation under severe impact is Kenya, which is located in East Africa at the earth's equator. Currently, the demand for food outpaces the supply in Kenya. The country's droughts and erratic weather patterns reduce the amount of arable land and destroy crops and livestock, making the gap between supply and demand even bigger. The output of crops in Kenya is insufficient to satisfy the nutritional needs of the people. Through the use of genetically modified organisms (GMOs), Kenyan farmers can lessen the severity of climate volatility on Kenya's food production and increase their well-being.

*One rural Kenyan family negatively affected by climate volatility is the Omayeni family, consisting of two parents, a son, Adebayo, and a daughter, Nneka. They own a farm and grow mainly maize and beans. The farm is 3 hectares (ha), which is around 7.5 acres. They eat what they can produce from their farm or purchase in the local market: usually corn, beans, potatoes, beans, and occasionally meats. They use inter-cropping, tilling of the land, a crop-livestock system to farm, and oxen and mouldboard plows to weed. The entire family works on the farm, but they produce just enough food to feed themselves. With very low income, the family has financial troubles.*

*The Omayeni family is currently attempting to get health care. They have tried in the past, but many obstacles have prevented them from succeeding. The biggest hindrance for them is that they have been unable to afford it. Even though both the daughter and the son have access to education through the Free Primary Education policy and would like to attend school, their help is needed at home on the farm, so they cannot go to school.*

In Kenya, the average family consists of two parents and 2.4 children. (Kiriti) The three main crops in Kenya are corn, coffee, and tea. The farm families in Kenya diet on staple foods that consist mainly of corn, beans, greens, maize, potatoes, and beans. Meats such as beef, goat meat, and fish are limited to certain regions. (Food in Kenya) The average farm size in Kenya is around 2.5 ha, which is about six acres. Crops are divided into high, medium, and low potential areas based on how well the crops will grow. The crops grown in the high potential areas are maize and beans, but the major undertakings are mainly coffee, tea, horticulture, and dairy production. A mixed crop-livestock system is practiced in the high potential areas as well as the medium potential areas. People are migrating from high potential areas to medium and low potential areas due to the land scarcity caused by population growth. In the medium potential areas, the main produce are beef, small ruminant production, and low rainfall crops. However, farmers use the same practices on these lands as they do on high potential land. They might plant high rainfall crops in low potential areas, use inter-cropping or intensely till the land. (Kamau) These practices result in crop failure, malnutrition, famine, and increased poverty, which ultimately have a negative effect on human welfare. As a result, 15% of Kenya's children are malnourished.

Healthcare in Kenya is hard to obtain for farm families. There are many barriers, including threat of harassment, cost discrepancies, real or perceived discrimination, documentation requirements, and language barriers. (Arnold) Millions of Kenyans are not able to pay for health services at public or private clinics. Although public health insurance has been available since 1966, only 20% of Kenyans have access to some sort of medical coverage. (Improving Health Care)

Education in Kenya is free because of the Free Primary Education (FPE) policy established in 2003. (Quality and Access) FPE led to dramatic increases in enrollment, but providing a quality primary education and an adequate amount of school remain challenges. Regional differences in school attendance result from regional inequality in economic development. In the wealthiest 20th percentile, 99% of children were in school, compared to 84% of children from the poorest 20th percentile in 2008 and 2009. Many have benefited from the FPE policy, but the gap between the rich and poor continues to exist. (Onyango)

### **Issues and Challenges on Food Production**

*The Omayeni family has not been producing as many crops as they used to because of climate change-- primarily droughts. A vast majority of their crops are lost to the drought because they do not have the resources to water them. The land they owned started off semi-arable, but over time, it dried out. Changes in the climate have depleted their land's minerals, and the nutrients have all been sapped. Their overall productivity is massively stunted by these droughts. As the droughts have become more frequent and more impactful, the situation is only getting worse and the Omayeni's overall agricultural productivity is decreasing, along with their well-being. Presently, the situation is bad enough that they can barely produce enough food to feed their family despite their hard work, and with the ongoing drought, they may never be able to do so.*

*Without the funds or knowledge to mitigate the effects of these droughts, the family does not know what to do. The situation is only getting worse with the population growing and the supply of food declining. They are isolated and cannot receive any outside help. Both the son and daughter will have to work on the farm, possibly for the rest of their childhoods.*

A major barrier for agricultural productivity in the 21st century has been climate change. According to the Stern Review on the Economics of Climate Change-- an important report on the effects of climate change and global warming, "The poorest countries will be hit earliest and hardest by climate change, even though they have contributed little to causing the problem." Another barrier that prevents the improvement of agricultural productivity in Kenya is the poor starting conditions. The lands started off semi-arable, and the farmers did not have the proper equipment or support to mitigate the state of the soil. The agricultural productivity is currently not high enough, but it can be increased, and these barriers can be overcome with the additional help from governments, organizations, and institutions. (Agriculture and Challenges)

Agriculture supports around 75% of the population of Kenya and generates most of the country's food requirements. A major constraint to agriculture production involving rainfall is droughts. The effects of this limitation are most clearly seen in the fact that only 20% of Kenya's total land is able to be farmed on, and it is only going to get worse. In the last 100 years, Kenya has recorded 28 droughts, three of them taking place in the last decade. The droughts have been increasing in number, frequency, and magnitude. Kenya has major droughts every ten years and minor ones every three to four years. The country has declared five out of the seven national disasters to be droughts in the last 22 years, with severe droughts occurring in 1964, 1984, 1996, 2004, 2006, and from 2007 to 2009. These extreme dry conditions cause severe food shortages by killing the crops, leading to a total crop failure, and killing livestock. Due to the resulting food insecurity, around 28 semi-arid and arid areas are in the Emergency Operation Programme. (Huho) The problems will only intensify as time passes and the climate changes. Ayub Macharia, the head of the National Environment Management Authority says, "As a result of climate change, there will be increased frequency and intensity of extreme weather conditions, like drought and floods." (Saulo)

Agriculture is a huge part of Kenya's economy, making up 26% of Kenya's gross domestic product and 75% of the jobs. Changes in rainfall have a massive effect on the country's economy because of its

dependence on agriculture. Rainfed agriculture is currently the dominant source of staple food production, supporting the lives of the rural poor in Kenya and continuing to do so in the years to come. (MacMillan)

Climate model simulations that take into account a wide range of possible greenhouse gas emission scenarios show that the median increase of temperature in Africa by the end of the 21st century will be 3-4°C. This is about 1.5 times the global mean response. A rough estimate has been predicted for the increase of precipitation levels in Kenya, which come out to be a .2-.4% per year. This seems like a good thing, but due to the rising temperatures, evapo-transpiration increases and causes diminutive, if any, increases in the amount of time for growing crops and crop productivity. (MacMillan)

Improving or mitigating climate volatility would yield nutrient rich soil and create more arable land to farm, increasing food quality and crop yields, . When crop yields become sufficient enough to feed farmers' families and villages, they would be in a better position to help one another and to take their crops to market. Economic development would improve as new markets for crops, such as villages, cities, and other countries, are created. New markets would reduce poverty by providing opportunities for farm work. This economic development is even more crucial as the population grows.

Another issue facing the country is urbanization. Population growth in the following decades would increase the demand for food, but the supply would be insufficient to match it. Population and urbanization growth would require more houses and other infrastructure to be built, taking away land for farming. Water scarcity would continue to decrease agricultural production and farmers' abilities to fight droughts and other erratic weather patterns. The shortage of farmable land, personal food supplies, and farming income would diminish even further. Ultimately, there would be an increase in poverty and famine, unless there is a way to alleviate the harsh effects of these droughts. The solution I present here could potentially yield the same results as solving climate volatility, if it was possible.

### **Proposed Solution**

The farmers cannot control when the droughts come, but with the help of the government, they can fight the effects of the droughts using drought resistance or flood tolerant genetically modified crops. In other parts of Kenya where drought is not the problem, but perhaps flood is, flood tolerant GMOs can be distributed. A GMO is a combination of genetic materials from two or more individual organisms in order to create a single organism with the most beneficial features of the parent organisms. In Burkina Faso, GMOs are used to increase production and to grow crops with more vitamins and minerals. By using GMOs, Burkina Faso's total economy has increased by around \$100 million per year. (Adenle) From the eight Millennium Development Goals that aim for international development, I recommend goal 1 and goal 7. Goal 1 is to eradicate extreme hunger and poverty, and goal 7 is to ensure environmental sustainability. It is necessary to develop even more efficient and effective GMOs using available technology in order to further increase agricultural production. There needs to be investment in educating farmers that will be given the GMOs on what they are and what farming practices to use with them. In order to achieve both Goal 1 and 7, crop production needs to be increased, and this is where the use of GMOs comes in. Some issues that come up are where to get the fund to buy the seeds, how to import them, and distribute them. Some of the possible solutions are getting help from Kenyans in support of the GMOs, NGO's (Non-government organizations), and also through fundraising and volunteer work.

Two local projects in Kenya that can be scaled up successfully and work alongside the use of GMOs are project Waterlines and project Gold Finger. Waterlines, founded by Linda Golden in the late 1990s, was a program that held water projects for women's self-help groups. It then distributed water collection tanks to many churches, schools, and health clinics within Kenya. In 2008, Waterlines partnered with Tenwek Community Health and Development to start a program called WASH- Water, Sanitation, and Hygiene education. So far, this program has given 35 schools a rainwater-harvesting system, hand washing stations, bathrooms, hygiene education, and water purification. In the future, this number is expected to

grow at a faster rate. Other projects that Waterlines has started are rain harvesting systems in the Southern Rift Valley due to its heavy rainfall pattern. The system uses the corrugated metal roofs of buildings (used to catch the rain), roof gutters, and ferro-cement tanks to store the water in. These tanks have a capacity of 30,000 to 50,000 liters and use bio-sand to purify the water. Waterlines has started more than 500 rain-harvesting systems and 20 community spring development projects. This helps children by getting rid of the need to spend several hours a day collecting water and gathering wood to boil the water. Waterlines is enabling the students to receive an education, rather than carry water. (Reimers)

In Ngorano, Kenya, there are many problems facing agricultural productivity -- lack of fertilizer, basic knowledge of farming practices, irrigation system and good quality seeds. Zellipah Guthui has been through this experience before. In the last years, Guthui has gone back to her village to help women farmers and their families. Along with her knowledge of farming, she also provided the farmers with hybrid corn seeds and higher quality fertilizers. The success of this project was quickly noticed by the other farmers in the village. The project is named "Gold Finger" because they believe that the finger of a woman can produce "gold" if given the right equipment and resources. This project was launched during a very large drought, one of the worst in 60 years, giving the farmers a chance to put their practices to the test. They had more success than any other farmers. For the first time in 20 years, using tomato and kale seeds along with drip irrigation, a mother of four did not need to buy vegetables for her family because she could produce enough. Guthui says that, "When you introduce new ideas that fundamentally change the way people have practiced their craft for decades, it's good to do it on a small scale and let the dramatic results spread the word." This project has now grown to include livestock, mainly goats and poultry. Guthui has requested to turn this local project into a non-profit organization. She wants to change the lives of many more farmers in rural Kenya by giving them better seed and fertilizer, new and better farming practices, as well as the means to enhance their watering techniques. (Niven)

The project Waterlines and project Gold Finger can work together alongside drought tolerant GMOs to change the lives of many more farmers in Kenya. Project Gold Finger supplies the farmers with seeds, fertilizers, and new farming practices, while project Waterlines can supply them with water so that they can carry out these new practices. Guthui says that she wants to improve the watering techniques of these farmers, but with the ongoing droughts, it will be a huge struggle. If project Waterlines supplies the water for them to use in irrigation or other practices, the farmers will finally start to produce enough food to feed their families with some extra to share with their neighbors or to sell at markets. Soon, the supply of food will increase and there will be fewer starving people in Kenya. Eventually, the farmers will have an abundance of food to export to other countries, thus economically helping the country itself and the people of Kenya. These programs are successful because the benefits are immediate, and the locals trust these programs and also have an interest in them. Organizations such as these can be supported in their work through funding and volunteer work.

In order to give these farmers GMOs, the national government should first purchase those using cash or credit based on future crops. They could buy it from the leading GMO producer, Monsanto, which is a U.S. based company. From there, the national government can distribute the GMOs to the local governments, and they can continue distributing the seeds locally. They will allocate the GMOs based on which areas are affected most by drought. The farmers need to be taught how to use these new seeds, and project Gold Finger can send people to educate these farmers on the techniques and practices that result in the highest production. Once the farmers are given the education and have obtained the seeds, they can start planting. When the amount of food grown is enough to feed the farmer's family, then they can start to export their crops. I recommend that the practice of GMOs in Kenya follows a three year timeline. Within these three years, trials will be held to see how to most efficiently implement GMOs and promote the practice nationwide.

## **Conclusion**

Although GMOs are controversial, and many people are fearful that they are not safe, the use of them will benefit the well-being of everyone in Kenya. The benefits that GMOs will provide to Kenya and eventually the world outweigh the diminutive risks that the genetically modified organisms pose. GMOs are beneficial because they can be tailored to a specific environment, they are not geographically limited, they greatly increase crop yield, and they provide a more efficient as well as direct solution. More specifically, GMOs should be considered as a serious solution to climate volatility in Kenya as opposed to other alternatives because it is more efficient than any other solution. The GMOs solution uses an existing system that has been in place for centuries, farming! The farmers are able to maintain their trades. Because GMOs do not have a high learning curve for implementation, the farmers do not need to learn an overwhelming amount of new information. The implementation of GMOs in Kenya will alleviate or fix many issues such as hunger, water usage, and economy. Even though these solutions present themselves with the implementation of GMOs in Kenya, many people are negligent to use them because they do not understand what GMOs are and are scared because GMOs are artificial and unknown to those people. Educating these people on GMOs will very much help to combat this problem.

The demand of food in Kenya is high due to the population growth, but the supply cannot meet the demand because of water scarcity and climate volatility. Climate volatility affects almost all of the farmers throughout Kenya. The droughts impact their crops and the amount of land these farmers can use, causing them to produce an insufficient amount of food for their families and communities. The frequency and magnitude of the droughts will become worse as time passes, and the effects will devastate the farmland and crops. Finding a way to fight this problem would allow the farmers to increase their supply to match the demand, resulting in fewer people starving. Farmers will have extra crops, and they can sell their crops at open new markets to different communities and countries. With the use of GMOs, this problem can be reduced, positively affecting everyone in Kenya. The GMOs will allow the farmers to produce crops at a rate that they have never achieved before. Eventually Kenya will export crops to many other countries, prompting the economy to bloom at exponential levels and decreasing the amount of rural poor and homeless people. The country will grow richer overall with the potential to become one of the most major exporters of coffee, tea, and horticulture products.

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