

Maggie Wang
Half Hollow Hills High School East
Dix Hills, New York
Kenya, Factor 6: Sustainable Agriculture

Combating Food Insecurity in Kenya with Sustainable Agriculture

Introduction

Situated on the east coast of Africa and straddling the Equator, Kenya is home to approximately 53 million people (Central Intelligence Agency 2021). This includes both native Kenyans and also hundreds of thousands of refugees fleeing conflict. Kenya's geographic and climatic regions differ dramatically from the Lake Victoria Basin, to eastern plateau forelands, and the Rift Valley. The nation's interior is arid; its coast is tropical; and precipitation can be erratic. Temperatures average 29 degrees Celsius, with an annual precipitation rate of 10 inches of rain in the north and less than 20 inches in the south. From December to March and again from June to August, much of the nation remains relatively dry whereas rainfall increases from March to May ("Kenya").

Government Structure

Kenya first obtained independence from Britain in 1931 ("The Government"). Since then, Kenya has maintained its independence as a presidential republic. This system of government consists of an executive branch that is completely separate from its legislative government. The current head of the government is President Uhuru Kenyatta who, along with previous presidents, was elected through general elections that take place every five years ("International Alliance of Libertarian Parties 2018"). Kenya's legislative branch consists of a National assembly with 290 members and a Senate with 67 members - each with a set number of experts to help on many global issues. Finally, Kenya is also split into 47 counties, each run by a different county government. ("The Government").

Economics

Kenya's economy is predominantly reliant on agriculture. Thus, approximately 72.49% of its population lives in rural areas, as stated by the World Bank Collection of Development Indicators ("Kenya: Demographics" 2020). Along with this, Kenya has dedicated a great amount of land solely towards agriculture. This is depicted as 48.1% of their total 580,367 sq km of land is allocated towards agriculture (Central Intelligence Agency 2021). The average farm size in Kenya is on the smaller scale as it is less than 2.5 hectares, or approximately 4.7 football fields ("Companies" 2020). Native Kenyans tend to gravitate towards growing sugar cane, milk, maize, coffee beans, potatoes, bananas, camel milk, cassava, sweet potatoes, mangoes/guavas, and cabbages. They export a wide variety of these agricultural products in addition to tea, petroleum, fish, cement, and apparel ("Companies" 2020).

Kenya has a multitude of job opportunities readily available to its citizens. The most common jobs are found in the agricultural industry. According to the USAID, an organization dedicated to promoting economic prosperity, the agricultural sector alone employs more than 40% of Kenya's total population ("Agriculture and Food Security 2021"). Jobs in sales, finance, health, manufacturing, hospitality, and services are also prevalent among Kenyans (MuekeDoreen 2018). The CEIC, an information center dedicated towards holding economic data, states that the average wage as of 2019 was 778,248.000 KES, or \$7,090.82 ("Kenya: Average Wage Earnings").

Family and Nutrition

A typical family in Kenya consists of an estimated 4.4 members (Munene). A diet normally contains staples such as maize, millet, and sorghum, which are eaten with varying meats and vegetables. The most common meals are Ugali, a maize flour porridge; Sukama wiki, a dish made with collard greens; and nyama choma, a dish with grilled goat meat (“The Food of Kenya”). Kenyans typically obtain their food from either growing it themselves or simply buying it from a market.

Education and Healthcare

Among other African countries, Kenya has a relatively more advanced national education system. This system consists of 8 years of primary education, 4 years of secondary education, and 4 years of higher education that is accessible to all children (“Education”). However, the tradition of placing males at higher importance still holds true. This is not limited to education. Oftentimes, families choose to invest more time and money into ensuring their sons' education rather than their daughters'. Because of this, girls have a disadvantage when obtaining an education. Coming from a relatively wealthy background is advantageous as they can pay for more resources to succeed in school or even pay for private education (Verweyen 2012). Thus, the conclusion that education is accessible to all children does have its limitations. Other drawbacks to the Kenyan education system include most primary schools not being able to accommodate the increase in demand for services and resources from Kenya's immense population size (“Education”). Kenya also provides both public and private healthcare systems. Similar to its education system, Kenya's public healthcare facilities are heavily lacking. This is demonstrated as most facilities tend to be understaffed, lacking supplies, and poorly equipped (Mohiddin & Temmerman 2021). With the onset of the COVID pandemic, these shortages have been further exacerbated. Private healthcare systems, on the other hand, are significantly more advanced, however, it is a luxury only available to the few who can afford it (“Education”).

Infrastructure

Among all of Kenya's problems, one of the most drastic is the lack of adequate transportation. Throughout the country, roads are commonly in poor condition or are simply lacking. This results in heavy increases in costs to transport food. This is demonstrated as transportation alone accounts for $\frac{2}{3}$ of the cost of Maize (Njogu 2020). Most Kenyans also do not have easy access to markets. This is especially the case in regards to smallholder farmers (Njogu 2020). Kenya is also unable to provide its citizens with an adequate amount of water. Kenya has suffered from water scarcity for decades due to frequent droughts, poor management of water, climate change, contamination, and a rise in demand due to a drastic increase in population. This has ultimately led to 17 million Kenyans who do not have access to clean water (Marshall 2011). In addition, only 59% of all Kenyans have access to basic water services and only 29% have access to sanitary services (“Water, Sanitation and Hygiene”).

Causes of Food insecurity

In the context of all the basic necessities Kenya is lacking, water is arguably the most important. Kenyans are also often left to rely on polluted water that will cause fatal diseases such as cholera (Marshall 2011). Individuals who live in rural areas especially suffer from water scarcity as the World Bank states that less than 50% of Kenya's rural population has access to water, whereas 85% of its urban population has access (“Kenya's Pastoralists” 2020). This is especially concerning as human health is dependent on clean water for not only daily living but also agricultural purposes. Thus, water scarcity has a dramatic impact on food production and accessibility. Kenya's growing population size also has a direct impact on agriculture. Recently, the conditions in Kenya have improved drastically as they were able to decrease their mortality rate while increasing their life expectancy. This in combination with the staggering amount of refugees immigrating from neighboring countries is increasing its population exponentially. Because Kenya is

unable to accommodate this large population in terms of food, Kenyans constantly have to suffer from a lack of food. This issue is further emphasized by ongoing land disputes: tillable land is extremely desired, but limited. Birch, an accredited researcher who focuses on agriculture, observes that conflict over land undermines the productivity of the land by 13% (Birch 2018). This is due to the fact that individuals are often so consumed with simply obtaining the land that they do not care for the land and yield of crops as much, thus contributing to Kenya's food insecurity. This especially holds true as oftentimes, the government fails to accommodate Kenya's rising population and permits many individuals to suffer from hunger. Land desertification also is a leading factor in Kenya's food insecurity. This is primarily due to their current agricultural practices. Because of Kenya's extensive use of land and poor irrigation practices, a process known as soil nutrient mining is occurring. Soil nutrient mining consists of depleting soil of its nutrients and fertility. This not only makes soil susceptible to erosion but also severely decreases the productivity of farms (Mulinge et al. 2015). All these factors have been accumulating over time to erode Kenya's food security.

Recent events in the world have also greatly contributed to Kenya's hardships. Currently, Kenya is experiencing its worst locusts invasion in 70 years that is even expected to multiply 400 fold by June ("Kenya's Pastoralists" 2020). Locusts are large grasshoppers that consume crops voraciously at an extensive rate. This is occurring because the environmental conditions recently have been well suited for locusts to thrive in, thus making their numbers multiply exponentially. The issue regarding locusts is extremely severe as it is deteriorating food production for Kenyans. In addition, locusts move at a high speed as swarms of 40 million are able to travel 150 km and eat 80 tonnes of vegetation per day ("Kenya's Pastoralists" 2020). Pesticides are being currently used in Kenya, however, they prove to be inefficient as they indirectly harm a multitude of animals.

Impacts of Food Insecurity

These issues above have ultimately led to detrimental effects on Kenya's citizens. According to the USAID, 14.5 million Kenyans face food insecurity and poor nutrition each year and 1.3 million people are facing a food shortage crisis ("Food Assistance" 2020). This has devastating effects on Kenya's society as 25% of children in Kenya are stunted from growth due to poor nutrition. Even more serious, the number one cause of death in children under 5 is malnutrition, with 337,000 children suffering from it (Uedoi 2018).

Solutions

It is clear that the above problems are severely harming Kenyans. Thus, change is needed and can be most effectively done through the form of new agricultural practices. This can be done with the widespread use of *Cajanus cajan*, or pigeon peas. Pigeon peas are legume crops commonly grown in the tropics and the subtropics. Pigeon peas are notable for having a good source of protein, vitamins, and fiber. They are also low in saturated fat, cholesterol, and sodium, thus making them even a substitution for meats. Pigeon peas can even be stored for 7-10 days when refrigerated (Mayzelle 2014). Unlike most other crops Kenya is growing, pigeon peas are drought tolerant. Thus, pigeon peas have the potential to achieve 20%-30% higher yields than regular non-drought tolerant plants (Birch 2018). In addition, this variety of peas are able to better the health of the soil. Pigeon peas have the ability to act as a cover crop and a windbreaker due to their deep roots. This means that when planted, they can drastically reduce soil erosion by keeping it in place and making the soil less vulnerable to being blown away by wind or move from runoff. Pigeon peas also have benefits even when they die. Once these peas die, their root nodules are able to release nitrogen that can then be used by other plants (Mayzelle 2014). Thus, the benefits of pigeon peas clearly indicate that this kind of crop could contribute substantially to minimizing or eliminating food insecurity in Kenya.

The implementation of Greywater would also prove beneficial in Kenya. Greywater is defined as gently used water from sinks, showers, tubs, and washing machines that have not been in contact with any fecal matter. Greywater has been demonstrated to be a viable option for conserving water. This can be done by reusing the water for purposes such as irrigation and flushing toilets ("Eat the View"). Donna Ferguson, an award-winning journalist who specializes in water conservation, states that Greywater can decrease water consumption by 50% (Ferguson 2014). Therefore a country like Kenya, in which water scarcity is greatly impacting its food production, can drastically benefit from remediation and repurposing used water. However, Greywater can have the potential to impose consequences on individuals. This includes the fact that it could prove harmful when accidentally ingested. Thus, extra precaution has to be taken to ensure Greywater will not get on the crops directly, but rather its roots only. In addition, there are cultural implications that could hinder its success. According to Louise Sarant, a freelance journalist who specializes in environmental scientists, the reuse of Greywater could be perceived as forbidden to the Islamic religion. This could drastically undermine the full use of Greywater as Islam is the second most practice religion, with approximately 5.2 million Kenyans practicing it ("Kenyan Culture" 2021). However, this could be resolved by perhaps issuing a special label for crops that states it was grown in Greywater-irrigated fields, so specific groups of people can avoid these crops. Despite these drawbacks, Kenya should still implement widespread use of Greywater as remediated water can still have overwhelming benefits for the country.

The use of biopesticides may prove especially effective in mitigating the effect locusts have on crop production. Biopesticides are a specific form of pesticides derived from natural ingredients. Unlike other conventional pesticides, biopesticides have the ability to specifically target certain pests, rather than killing everything that comes near. In addition, they are effective in smaller quantities and can decompose quickly, thus preventing pollution ("What are Biopesticides?" 2016). One specific biopesticide that Kenya could greatly benefit from is fungi of the metarhizium acridum family. This is commonly sold in powder products that can then easily be mixed with oil and sprayed onto fields. Once this is completed, the fungus is then able to penetrate through the locust's outer layer and begins to feed on it, stripping it of its energy. As time goes on, the locusts progressively become weaker and weaker until they eventually die within 1-2 weeks ("Photo Detail" 2020). This specific pesticide is also easily accessible. The cost of this pesticide can be as low as \$4 per kg, thus proving to be pragmatic. This is shown as Somalia, a neighboring African country that also suffers from locusts, had adopted this practice and was able to greatly help its citizens control the pest ("Photo Detail" 2020). Despite these benefits, a slight implication of biopesticides is that they kill pests at a slower rate compared to traditional pesticides (Chandler et al. 1998). Regardless, biopesticides are still indicated to be superior to chemical pesticides.

Finally, drip irrigation should be implemented in Kenya to further alleviate the effects of food insecurity in Kenya. Drip irrigation entails watering crops through the use of pipes to periodically drip water directly on the surface of the soil. Using this method of irrigation is able to conserve 30% to 50% of water compared to conventional irrigation means ("Eat the View"). This, in combination with its ability to prevent runoff of water to areas that do not need it, is able to drastically conserve water and enable more agricultural success in the future. Using drip irrigation collaboratively with Greywater would also easily ensure that the Greywater will only reach the roots of above-ground crops, thus eliminating the threat of its consumption. Further benefits include the fact that it will also be able to apply pesticides at a more effective rate as this will prevent pesticide runoff ("Eat the View").

A drip irrigation system has also been proven useful in other countries. India, similarly to Kenya, also suffers from water scarcity. However, India is one of the few countries that have implemented a drip irrigation system to mitigate their water crisis. In a study conducted by Dr. Suresh Kumar, an accredited doctor who focuses on the issues of water scarcity, Kumar examined the effect of drip irrigation on bananas. Kumar was able to confidently conclude that drip irrigation does conserve a substantial amount of water. In his experiment, it was stated that those who did not adopt drip irrigation used a total of 21316.9m³ of water whereas adopters only used 8506.3 m³ of water in 2007-2008 (Kumar 2012). Thus implementing a drip irrigation system in Kenya could prove beneficial in conserving water, while having the same yield in crops. In addition, the water conserved can then be further used to nourish even more farms in the future. It does have to be acknowledged that India and Kenya do have different governments that may impose complications when implementing the system in Kenya. However, the benefits of drip irrigation are so great that they cannot be completely ignored (Kumar 2012).

One potential disadvantage of installing this irrigation system is its high initial cost, especially since most Kenyans would not be able to afford the equipment. However, a drip irrigation system developed by the International Development Enterprises is shown to be a more acquirable system. According to Amy Smith, an educator, inventor, and mechanical engineer at MIT, conventional drip irrigation can cost up to \$3,000 for one hectare, while this specifically designed system costs less than \$500 per hectare (Smith). The quality of this system is also still maintained, despite its low cost, as it is able to last up to 2 years.

Conclusion

Overall, even with these viable solutions at hand, none of them could be implemented without support and funding from donors, charities, and non-government organizations. One example of an organization is the Bezos Family Foundation that donates millions of dollars to different global issues through student participation. Kenya's government must work collaboratively with these groups in order to ensure long-term societal benefits that even agricultural practices cannot fix, such as improving infrastructure, education, and healthcare. Additionally, Kenya's government and these groups must allocate more time, effort, and money towards these new agricultural practices to ensure the efficacy of the project. It is when this occurs that Kenya will truly see change.

Works Cited

- “Agriculture and Food Security: Kenya.” U.S. Agency for International Development, 25 Feb. 2021, www.usaid.gov/kenya/agriculture-and-food-security#:~:text=The agricultural sector is the,has stagnated in recent years.
- Birch, Izzy. “Agricultural productivity in Kenya: barriers and opportunities,” Dec. 2018, K4D, https://assets.publishing.service.gov.uk/media/5c70028ee5274a0ecbe9a1c2/483_Agricultural_Productivity_in_Kenya_Barriers_and_Opportunities.pdf
- Central Intelligence Agency*, Central Intelligence Agency, 2021
www.cia.gov/the-world-factbook/countries/kenya/.
- Chandler, David et al. “The development, regulation and use of biopesticides for integrated pest management.” vol. 366,1573 (2011): 1987-98. doi:10.1098/rstb.2010.0390
- “Companies -.” Acumen, 8 Dec. 2020, acumen.org/investment/juhudi-kilimo/#:~:text=Eighty percent of the Kenyan,than 2.5 hectares of land.
- “Eat the View.” Eat The View, eattheview.org/advantages-disadvantages-drip-irrigation/.
- “Education.” *Encyclopædia Britannica*, Encyclopædia Britannica, Inc.,
www.britannica.com/place/Kenya/Education.
- Ferguson, Donna. “Greywater Systems: Can They Really Reduce Your Bills?” The Guardian, Guardian News and Media, 21 July 2014,
www.theguardian.com/lifeandstyle/2014/jul/21/greywater-systems-can-they-really-reduce-your-bills.
- “Food Assistance Fact Sheet - Kenya: Food Assistance.” U.S. Agency for International Development, 22 Apr. 2020, www.usaid.gov/kenya/food-assistance.

International Alliance of Libertarian Parties, 25 Mar. 2018,

[ialp.com/presidential-republic/#:~:text=A presidential system is a, state, which is called president.](#)

“Kenya.” Encyclopædia Britannica, Encyclopædia Britannica, Inc.,

[www.britannica.com/place/kenya/climate.](#)

“Kenya: Average Wage Earnings: Economic Indicators: CEIC.” Kenya | Average Wage Earnings | Economic Indicators,

[www.ceicdata.com/en/kenya/average-wage-earnings-by-sector-and-industry-international-standard-of-industrial-classification-rev-4/average-wage-earnings.](#)

“Kenyan Culture - Religion.” 2021, Cultural Atlas,

[culturalatlas.sbs.com.au/kenyan-culture/kenyan-culture-religion.](#)

“Kenya: Demographics: World Bank Development Indicators.” Kenya | Demographics | World Bank Development Indicators, 2021

[tradingeconomics.com/kenya/indicators-wb-data.html?g=demographics.](#)

“Kenya's Pastoralists Face Hunger and Conflict as Locust Plague Continues.” *The Guardian*, Guardian News and Media, 15 May 2020,

[www.theguardian.com/global-development/2020/may/15/kenyas-pastoralists-face-hunger-and-conflict-as-locust-plague-continues.](#)

Kumar, Dr. D. Suresh. “Adoption of Drip Irrigation System in India: Some Experience and Evidence,” 2012, Vol. 35, No. 1,

Marshall, Samantha. “The Water Crisis in Kenya: Causes, Effects and Solutions,” 2011,

https://www.american.edu/cas/economics/ejournal/upload/marshall_accessible.pdf

Mayzelle, Megan. "Pigeon Pea Nutritional Benefits," 2014, UC Davis,

<https://afghanag.ucdavis.edu/grain-field-crops/files/pigeon-pea-nutrition.pdf>

Mohiddin, Abdu and Temmerman. Marleen. "COVID-19 Exposes Weaknesses in Kenya's

Healthcare System. And What Can Be Done." *The Conversation*, 14 Jan. 2021,

theconversation.com/covid-19-exposes-weaknesses-in-kenyas-healthcare-system-and-what-can-be-done-143356#:~:text=Kenya's healthcare system is made,3% are run by NGOs.

MuekeDoreen, Doreen, et al. "Top 15 Jobs That Dominated the Market in Kenya 2018 I

BrighterMonday." *BrighterMonday Kenya*, 16 Dec. 2018,

www.brightermonday.co.ke/blog/top-jobs-kenya-2018/.

Mulinge, Wellington, et al. "Economics of Land Degradation and Improvement in Kenya."

Economics of Land Degradation and Improvement – A Global Assessment for Sustainable Development, 2015, pp. 471–498., doi:10.1007/978-3-319-19168-3_16.

Munene, Francis. "HOUSEHOLD POPULATION AND HOUSING CHARACTERISTICS,

DHSProgram, <https://dhsprogram.com/pubs/pdf/FR151/02Chapter02.pdf>

Njogu, Eunice. "Millions of Kenyans Go Hungry Every Day. Why, and What Can Be Done."

The Conversation, 2 Nov. 2020,

theconversation.com/millions-of-kenyans-go-hungry-every-day-why-and-what-can-be-done-131782. "Photo Detail." Food and Agriculture Organization of the United Nations, www.fao.org/resilience/multimedia/photos/photo-detail/zh/c/1272227/.

Smith, Amy. "Low-Cost Drip Irrigation," MIT D-Lab,

http://web.mit.edu/D-LAB/resources/nciia_files/tb-di.pdf

"The Food of Kenya." *The Food of Kenya - Traditional Kenyan Cuisine*,

www.kenyasafari.com/food-of-kenya.html#:~:text=The main staples of Kenyan,you eat

with your hands.

“The Government and the Political System.” The Government and the Political System | KENYA

Embassy of the Republic of Kenya in Japan,

www.kenyarep-jp.com/kenya/government_e.html.

Uedoi, Kristen. “Top 10 Facts About Hunger in Kenya.” The Borgen Project, Borgen Project

https://borgenproject.org/Wp-Content/Uploads/The_Borgen_Project_Logo_small.Jpg, 19

July 2019, borgenproject.org/top-10-facts-about-hunger-in-kenya/.

Verweyen, Georg. “Kenya: Unequal Access to the School System: DW: 03.05.2012.” DW.COM,

www.dw.com/en/kenya-unequal-access-to-the-school-system/a-15880333.

“Water, Sanitation and Hygiene.” UNICEF Kenya,

www.unicef.org/kenya/water-sanitation-and-hygiene#:~:text=The WASH joint monitoring programme,for the survival of children.

“What Are Biopesticides?” EPA, Environmental Protection Agency, 12 Aug. 2016,

www.epa.gov/ingredients-used-pesticide-products/what-are-biopesticides#:~:text=Biopesticides often are effective in,problems caused by conventional pesticides.