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Somalia, Factor 1: Plant Science

Somalia: Cultivating and developing genetically modified crops to increase crop yields and food security

Food security is defined as when a population is no longer in fear of starvation with adequate nutrition and availability of food. Food security is a problem, not only in Africa, but globally. One seventh of the world's 925 million people are without adequate access to food, and two billion people have irregular food security. In developed nations, food is something taken for granted by a majority of the population, however in 22 countries more than one third of the population is consider malnourished with little access to health care. Somalia, not unlike a majority of the African nations, is considered a developing country. With a life expectancy of around 51 years of age, Somalis face many issues during the course of one day, food security being one of top priority. Around 33% of children under the age of five are considered underweight, with 23% of the total population malnourished. 71% of the populace relies on subsistence farming and livestock to provide food and income for their family. This causes rates of hunger and starvation to increase dramatically during recurring droughts and floods, as crops cannot survive the horrid conditions ("Somalia" 2013). Often times Somalis move from place to place in search of water and grass for their livestock; an estimated 60% of the population is actually considered nomads with no permanent home (Hassing, 45). According to the World Food Programme, "2.1 million people are facing an acute food security crisis" in Somalia alone, out of which 1.8 million people are considered food insecure and barely meet their minimum food requirements ("Somalia: Overview"). After years of rampant fighting and destruction in a catastrophic civil war during the 1990's, Somalia is finally beginning to once again establish a reliable government. However, the current transitional government does little to establish universal health care or agricultural production. If improvements to their food security aren't made, Somalia will remain a developing country for years to come.

Referred to as one of the most culturally and ethnically homogenous countries in the world, 85% of Somalia's population are considered members of the Somali ethnic group. Somalis believe that they share a common ancestor, Somaal, and practice the same language, culture, and Islamic religion ("Chapter 2. Overview of Somali Culture"). The official religion of Somalia continues to be characterized as Islamic, therefore it is common for families to consist of one husband and four wives who each live in separate houses with their children (Hassing, 67). As the national average indicates, each woman gave birth to an estimated six children in 2012, the third highest in the world. Somalia also ranks as the world's third highest for infant mortality and second highest for maternal mortality rates as well ("Somalia" 2013). Since divorce is common, children usually reside with their mother even if she remarries (Hassing 64), however women rarely raise their children alone as they're assisted and supported by members of the same clan. Clan membership is based upon patrilineal lineage and often displays a family's ethnic, societal, and geographic orientation. Whether members of the noble, agro-pastoral, or occupational clans, the Somali people often characterize themselves with which clan or sub-clan they affiliate themselves with, much like an extended family ("Chapter 2. Overview of Somali Culture").

Based on the overall economic status of Somalia, agricultural production, healthcare, and education is severely limited. As much of their agricultural and livestock production are for self-sustainability, Somalia's diet is limited mainly to crops they cultivate locally. The staple crops are considered to be rice, sorghum, maize, pasta, beans, bananas, and sheep and goat meat (Hassing, 121). The Somali people do not consume alcohol, lard, or pork as a tradition of the Islamic faith. Nearly 80% of Somalia's population has little or no access to even the most basic health care. This is due to the civil war, countless famines and floods, and the transitional government's inability to develop feasible health care (74). In 2006, there

were an estimated 0.035 physicians per 1,000 Somali people. With little access to health care, life expectancy lingers around 50 years of age and Somalis are especially vulnerable to infectious diseases, particularly food, water, and vectorborne diseases ("Somalia" 2013). With a civil war, a transitional government, and 60% of the population estimated to live as nomads, Somalia's education availability is also rather limited. In the 1970's educational opportunities and literacy rates began to improve once the Somali script became official and primary education became free ("Chapter 2. Overview of Somali Culture"). In 2001, Somalia's literacy rates, defined as ages 15 and over who can both read and write, were estimated for males at 49.7% and females at 25.8%, which continues to be a strong improvement, particularly during the recent years. However, school-life expectancy for a male is only three years with females even lower at only two in 2007 ("Somalia" 2013). In 2006, only 26% of children were enrolled in school, however the United Nations and Somalia Aid Coordination Body's Education Sectoral Committee has been collaborating to further develop and improve Somalia's primary school system (Hassing, 71).

Agriculture dominates Somalia employment with 71% ("Somalia" CIA), however only 1.6% of Somalia's total land area is cultivated. The main cash crops are corn, beans, vegetables, sesame, rice, sorghum, sugarcane, cotton, and bananas, most of which are also produced for self-subsistence and the surplus sold to foreign or local markets. There are two types of agricultural practice; indigenous and those instilled by European settlers. Since colonial times, Somalis have practiced "rain-fed dry-land farming or in dry-land farming complemented by irrigation from the waters of the Shabeelle and Jubba rivers or from collected rainwater ("Somalia – Agriculture")." The two rivers located in the southern region of Somalia are used for gravity-fed irrigation, and their upper sections contain deep river beds perfect for pumps in periods of drought or little rainfall for those who can afford it. These subsistence-based farms using rain-fed techniques have a typical size of two to four hectares. In the northern region, small-scale irrigation is used for farms less than two hectares and spate irrigation for farms less than ten hectares. The few commercial banana farms utilize more European cultivating practices with technological advancements, however since the civil war many of the irrigation infrastructures have been damaged or left unkempt. Italy used to be a main investor in Somalia's banana production, however in recent years their interest has decreased significantly after floods in 1997 demolished around 80% of the Somalia's banana farms, thus leaving the production cash and staple crops to small farmers ("Somalia" 2005). Due to irregular rainfall and underdeveloped agricultural practices that do not ensure nutrient soil, Somalia has been experiencing soil erosion as well. Soil erosion causes loss of organic matter, loosening of soil, and lowers soil productivity and quality, thus making reliable and desirable agricultural productivity hard to achieve.

As Somalia is considered a developing, third world nation, it is natural that they face numerous barriers in agricultural productivity, maintaining adequate nutrition, and accessing markets particularly in times of droughts and floods. A majority of Somalia's barriers are caused by their irregular climate. Somalia experiences two dry seasons with short rainy months in between. However, often times the rain doesn't arrive causing long lasting droughts, in which the crops cannot survive. With little industrial based towns and jobs, a majority of Somalis rely on such crops as not only their food, but their income as well, making the droughts even more devastating for families. Somalia is prone to malnutrition and starvation due to the unstable and undesirable environmental conditions and little medical care available. In 2006, it was estimated that 23% of Somalis were suffering from malnutrition (Hassing, 74). While irrigation is available in certain areas, it still results in low yields caused by low seed quality and lack of mechanized farming skills and technology such as fertilizer. Even after a successful harvest season, the local production of sorghum and maize does not meet the demand in Somalia. Domestically, food demands are estimated to be around 500,000 tonnes with imports from foreign distributors filling around 300,000 tonnes. The civil war also decreased agricultural productivity as the production of cereals has been down 60% in Somalia ("Somalia" 2005). This decrease was due in part by the war causing the destruction of farms, towns, roads, irrigation systems, and destabilizing the uniform government. The current status of their government also is a primary area of concern with the transitional government having little control

over the individual regions who each established their own pseudo governments during the civil war. Without universal laws it is hard to regulate agricultural practices, health care, and roads that would allow easier access to markets in distant towns.

By using agricultural biotechnology and breeding improved plant varieties to boost disease and drought resistance, Somalia can increase their crop yields. Expanding the quantity, nutritional value, and tolerance in crops can improve the lives of every small farmer in Somalia. Since a majority of the people rely on self-subsistence and the crops they cultivate as their primary food source, not only would they increase their food security, but they would also have surplus to distribute in local markets and have the capability to export to supportive international markets. The nutritional value of improved plant varieties would allow access to higher amounts of vitamins to fight malnutrition in Somalia. Currently, scientists have been able to genetically modify rice to produce beta-carotene, which is transformed into vitamin A in the human body. Agricultural biotechnology works by transferring desirable characteristics, such as heat tolerance, from one organism into a plant using DNA, a technique based upon selective breeding and Mendel's study of genetics ("Agricultural Biotechnology"). Crops with improved tolerance to droughts and heat would highly increase Somalis' food security by allowing them to cultivate seeds that have the potential to successfully produce in the unfavorable weather that used to limit agricultural productivity. Maintaining a stable food supply is often times taken for granted in developed countries, however the ability to have a reliable food source with the help of GM crops to withstand the droughts in Somalia would increase the food, nutritional, and economic security for around 10 million people.

GM crops would also benefit Somalia as a country as well. With farmers producing excess crops, they could sell more to local and foreign markets, which can improve the economy tremendously. The higher quantity yields can also decrease reliance on foreign aid and imports. Around 648 million dollars was sent to Africa from the United States alone as foreign aid assistance in 2010 ("U.S. Foreign Aid Summary"). With more than half of the country considered nomads, the availability of a stable income will allow them to become stationary as they no longer have to search for water and grass for livestock. With more stationary homes, more towns and structured communities will arise that have the potential to improve the economy as well. By developing and establishing domestic research base, Somalia can produce GM crops that are specifically suited for their environment. This would allow for improved plant varieties to be even more successful and aid the country economically and food security wise.

Presently, GM crops have not been introduced to Somalia as the debate on the safety of these improved plant varieties in developed nations continues to grow. Even though these crops would boost productivity and rural income of Somalis, organizations that believe GM crops are linked to health issues, despite the fact that not one of the rigorous research studies demonstrates this notion, have convinced many African governments to discourage the use of GM crops in their nation. As Nobel Peace Prize laureate, Norman E. Borlaug commented, "This is a rich-world argument that is hurting the poor." Norman Borlaug, father of the Green Revolution, believed that there should be less focus on the risk and more on making GM crops available to the poor. While 70% of the food in American supermarkets comes from GM crops, less than one third of the African crops planted are improved plant varieties. In Somalia, as poor become increasingly vulnerable to starvation and malnourishment, the introduction of GM crops remains at a standstill. Everyday, scientists in many areas of the world are searching and discovering new varieties of plants using agricultural biotechnology, why shouldn't Somalia be included (Paarlberg)?

Climate change, population growth, and water scarcity are all reasons GM crops are needed in developing nations, particularly Somalia. Somalia's climate has already proven to be disastrous through countless droughts and floods that have ruined numerous crops. With drought resistant crops Somalis could have the capability of reaping several harvests within a year, along with higher yields. With an increase in yield, Somalis could domestically produce the foods necessary for population growth with less reliance on foreign imports. Drought resistant GM crops can survive with very little water, thus the little water

available can be utilized for human and livestock use rather than agricultural needs. Without GM crops in the upcoming decades, Somali farms will not be able to produce as much foodstuffs to meet their nutritional requirements and food insecurity will rise along with population growth. With climate change, droughts are expected to increase in Somalia, thus forcing Somalis to utilize more irrigation and water for their crops, exacerbating the water scarcity issue. Without improved plant varieties, climate change will continue to decrease agricultural production while population and water scarcity increases.

To address the development of research and breeding plant varieties to improve drought resistance and increase crop yields, supportive organizations such as the United Nations and Millennium Development Goals, or MDGs, must work closely with the Transitional Federal Government, or TFG to allow access to the funding, establishment, and regulation of GM crops within Somalia. Right now, the TFG is work with MDGs to provide a transition plan to accelerate progress towards the goals ("Somalia: MDG Profile"), which is an opportune time to include GM crops into this plan. This will enable the government to take control and implement the usage and research of GM crops in order to improve the food security of the country so that they can become close to achieving the MDGs, particularly Goal 1: eradicating extreme hunger and poverty ("MDG Monitor"). By encouraging the government to lead this operation, the Somalis needs and opinions can be addressed directly by their country and the people won't feel undervalued or underrepresented and resent the operation.

The Ministry of Agriculture developed a strategic plan to ensure food security by improving crop production in 2001 and 2003, however the plans were unsuccessful ("Somalia" 2005). These plans can be revisited and revised, which can serve as the basis for governmental action regarding GM crop usage. In order to fully introduce GM crops to Somalia, several actions must be implemented beforehand with the collaborations of several organizations. Due to the Plant Breeders' Rights, it is necessary for the government to determine which patenting and licensing laws will be established within Somalia so that several public-private partnerships can become license-holders of the technology needed for agricultural biotechnology research. Companies usually take a royalty of sales in return for a license, however, in previous negotiations certain private companies had agreed to a royalty-free license for humanitarian use. Once the licensing agreement has been reached, the TFG can collaborate with seed distributors to provide discounted pricing of small quantities to smallholder farms so that the smallholder farmers who desperately need the seeds can afford the start-up capital (Paarlberg). In these negotiations, the United Nations could provide a substantial amount of pressure and influence on the seed companies to allow reduced rates, at least for the first few years. The World Bank could lend capital to Somalia, in addition to private investors, to establish the research areas so that scientists can begin developing crops suited especially for Somalia as soon as possible. International research agencies could also provide support and assistance so that the Somali research center could be established with the appropriate technology and equipment necessary for success.

The Somalia Aid Coordinating Body, or SACB, is the main governmental agency to develop and share techniques to improve health and nutrition and food security. This agency usually communicates for foreign organizations and countries to plea for humanitarian aid and assistance. However, the demand for humanitarian aid would decrease with the introduction of GM crops, as food security among the smallholder farmers would increase. Having them distribute GM crops that maintain higher resistance to drought and heat, as well as promoting environmentally friendly agricultural practices could scale up and improve the job of the SACB. The issue of soil erosion cannot be solved by utilizing GM crops, however, educating farmers about preventing this issue and the importance of retaining soil nutrients is pertinent to cultivating the most productive yields. By working with and establishing local organizations, the SACB can educate farmers on healthier practices, promote and distribute GMO seeds, while rallying support for the national campaign.

The rural smallholder family and youth should be involved in all steps of this process. They are the root of this program and should always have their best interests in the minds of the TFG and SACB. During negotiations with licensing and seed companies, the rural family should always be fairly represented and kept up-to-date of progress of the research center development. Experienced smallholder farmers should be consultants for SACB along with several developed nation farmers in order to establish recommended agricultural practices that are suitable for Somalia. Once a farmer has been educated of the recommended agricultural practices, he or she should take it upon himself or herself to share and encourage this information among clans. Upon the establishment of towns, it is natural for education to be more accessible, thus improving literacy rates. It is important for the government and the implementation of this plan to highly immerse themselves into improving the education system so today's youth is prepared for tomorrow's improvement.

While this is a worthwhile plan, it will take a considerable amount of time to fully implement the necessary actions, and in that time many barriers can stand in the way and further prolong the benefits of agricultural biotechnology in Somalia. The two most prominent barriers would be acceptance and the African Centre for Biosafety, or ACB. The ACB campaigns against the use of genetic engineering and is quite influential in the African nations. However, if the added support of the United Nations and influential Somalis, the campaign promoting GMOs can easily be as influential and eventually override the ACB in Somalia. Prominent activists during the Civil War who remain popular today, could be helpful to the implementation of this plan to help gain support, as well as local organizations involvement. To get influential leaders and the TFG to accept GMOs is the first integral part of the plan. Through meetings and negotiations with non-biased GMO researchers, seed companies, and the UN, it can be assumed that Somalis would be able to easily see the benefits of agricultural biotechnology in their country.

With 2.1 million Somalis facing a food security crisis it is necessary for the country to take actions to increase agricultural productivity with the help of drought resistant plant varieties. To gain support for the next Borlaug Green Revolution, the Somalis should be repeatedly reminded of the positive benefits that will arise from the cultivation of GM crops. Using drought resistant crops would allow for much higher yields, quality, and nutritional value of their harvest allowing for families to have access to food, thus increasing their food security. With the increase in productivity farmers may actually have surplus crops to allow them to sell in domestic or foreign markets. So not only would GM crops give farmers sustainability, but it would also allow for Somalia to become less reliant on foreign aid and markets by improving domestic productivity and economy. The 60% of Somali population that are referred to as nomads could potentially become stationary by having reliable crops and income. This could lead to the development of towns and communities to further increase the economic sustainability of Somalia, as well as yielding educational improvement . With agricultural biotechnology, Somalis would be prepared for climate change while at the same time increasing yields to help feed the increasing population growth. Without the need for as much irrigation, Somalis would have more water for themselves and their livestock. With the help of the Transitional Federal Government, Somalia can secure patenting and licensing agreements, as well as discounts from seed distributors. The World Bank, United Nations and international research facilities could aid and assist Somalia with the construction and establishment of a GM crop research center so that Somalia can produce improved plant varieties specifically designed for their country. The Somalia Aid Coordinating Body would educate farmers on how to improve agricultural practices to be more environmentally friendly and how to properly cultivate the GM crops to produce the highest yields. The rural farm holder and youth should be included within every step of this process so the transition to GM crops is as seamless as possible. The research and use of drought resistant GM crops to improve Somalia's crop yields will benefit rural farms and the country in many ways, most importantly it will get Somalia closer to its' Millennium Development Goals and improving Somalia's economic stability and food security. As Norman E. Borlaug once said, "The destiny of world civilization depends upon providing a decent standard of living for all mankind."

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