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Food Insecurity in Rwanda: A Biological Solution

Rwanda is a tiny landlocked nation located in East Africa. It is a country that has been rocked by ethnic conflict since the time it gained its independence from Belgium. The most recent example of the rivalry between the Hutus and the Tutsis was the culmination of the 1994 civil war which resulted in the genocide of roughly 800,000 Tutsis, the results of which are still reverberating today. According to an as of yet unreleased UN report, some of the violence may have continued even after the 1994 Tutsis defeat of the Hutu regime (Fisher). Despite the fact that the progress since 1994 is being called into question by these findings, Rwanda is still regarded as a model for government turnaround in Africa. In recent years this was characterized by an expansionary policy to overcome poverty through a variety of means including foreign and domestic investment and market-oriented reforms ("Rwanda" CIA). Its development as a country however, is far from complete. One area in which the country still must make vast improvements is agricultural production.

The staple crops of Rwanda are coffee, tea, pyrethrum (insecticide made from chrysanthemums), bananas, beans, sorghum, potatoes, and some livestock. A given farm would likely have some combination of these crops depending on geography and climate as well as availability of seeds and farmers' preference. The average farm is between .5 hectares and 1 hectare and is cultivated by a family consisting of two to three adults and two to four children ("Rwanda" CIA). Due to the prevalence of the disease, it is possible that a member of the family is suffering from AIDS or is positive for HIV, oftentimes preventing them from supporting the family by working in the field (Donovan). Many in Rwanda also face malaria. Although Rwanda provides free education in state-run schools, children from a poorer family would probably not attend due to the necessity of purchasing uniforms and books. Many children are also blocked from receiving an education because they are needed at home to work to support their families.

The degree of food insecurity and poverty in Rwanda remains alarmingly high. According to the Millennium Development Program over 60 percent of the population is living below the international line of extreme poverty, \$1US per day. In a country with a population close to 10 million this amounts to almost 6 million people ("Rwanda" CIA). Furthermore, nearly 12 percent of the population faces chronic malnutrition, with the number more than tripling for children under the age of five ("Malnutrition"). The harsh effects of food insecurity on children are reinforced by the percentage of child mortality that results from hunger, a shocking 45 percent ("Malnutrition"). Although the government has pledged to reduce hunger, and gains have been seen in recent years, the rural families that make up the largest fraction of the population are not seeing improvement in their quality of life or food security. According to the United Nations Development Program, almost all the economic growth generated in the last few years has benefited the wealthiest quintile of the population. In a country with only a fraction of people residing in cities, lack of improvement for the poorer portion of the population means that poverty is increasingly becoming rural in nature ("Rwanda" Millennium). This could lead to more severe poverty in the years to come as the population grows and a household's land is divided among subsequent generations.

The reason that food insecurity in Rwanda is most extreme among rural smallholder farmers is the low level of production seen from most crops. This is a result of poor seed quality,

inadequate fertilizer, unsustainable farming practices, and soil erosion, among other problems. As a result of low crop yields most Rwandans are subsistence farmers, sometimes not producing enough for themselves and their families.

Improving the conditions of rural Rwandans' healthcare, income, and access to education depends on bolstering farm production. Because 90 percent of Rwanda's population relies on agriculture for its income, improvements in farming practices and production could lead to a large decrease in the number of Rwandans living at or below the poverty line ("Rwanda" CIA). This can be achieved through a multifaceted solution that begins with improving the quality of seeds through the breeding of enhanced plant varieties. Currently, farmers rely on poor-quality seeds that have been saved or reused and do not result in high crop yields ("AGRA"). Modified seeds would therefore create a broad range of benefits that, when compounded, would have a significant effect on reducing poverty.

The key to adapting genetically modified seeds in Rwanda is to create plant breeds based on the unique conditions within the country. Seeds produced by large foreign corporations such as Monsanto should not be grown in the country because they were bred from American plants for conditions in the United States. Instead, these corporations, should encourage Rwandan companies and universities to produce seeds that will not only be better suited to Rwanda, but will also develop a Rwandan agricultural infrastructure that would allow farmers to buy modified seeds from within Rwanda, thus providing economic improvement. This process must begin with educating new breeders and plant specialists that have the skills to increase Rwanda's ability to produce and distribute its own new, high-quality seeds ("AGRA"). Budding research groups could follow the example set by the Institut des Sciences Agronomiques du Rwanda, which is already striving towards the goals of more productive and environmentally suited seeds, with the end goal of completely alleviating hunger throughout the country ("About").

Improved scientific research and seed breeding are not, however, the only innovation that Rwanda requires. Farmers must have also access to seeds before any of their benefits can be realized. This aspect of the food security equation is slightly more difficult than simply breeding higher quality plants because of the difficulties involved in creating a market for the new seeds. The best way to overcome this challenge is through integrating the new seed varieties into a network of agro-dealers that would operate on the local level to bring the higher quality seeds to rural farmers ("AGRA"). The first step is to begin providing emerging small retailers with the necessary training to be successful in selling and distributing seeds and becoming a certified agro-dealer ("National"). These people will be the connection between the seed production operations and cooperatives, a link between the providers of the new technology and the farmers who will most benefit from it. A network of local agro-dealers will also make farmers more likely to implement genetically improved seeds on their farms since they would be purchasing them from a local seller who would be more invested in the farmers' success than a large corporation.

The next obstacle in implementing this strategy for improving food security is the lack of credit available to most farmers in rural areas. Successful reduction of poverty and hunger using improved plant varieties will require farmers and agro-dealers to gain access to start-up capital through a variety of innovative means. One such method is through "guarantee facilities" that share investment risks fifty-fifty with agricultural firms that supply the agro-dealers in rural areas. This type of matching grant could also be utilized in the creation of seed production companies, new storage and processing facilities, as well as by farmers themselves ("National"). Possible financing partners include the Rwandan government, banks, and individual donors who could see their investments returned on a scale of 16:1, as was the case in Malawi where a similar system of providing credit was established ("National"). And after a period of five years, each dollar of

funding generated sixteen dollars worth of farm supply sales in rural areas. Furthermore, the loan default rate in Malawi was very low, less than 1.5 percent. Another effective means of ensuring access to capital is through the use of small microcredit loans with extended schedules of repayment that allow the farmer or business owner adequate time to earn back the money to pay off the loan.

The final element needed to ensure the success of improved plant varieties is overcoming the challenges that are associated with market access. These include, among others, high post-harvest losses and high transport costs. One way to improve market access is through establishing an agricultural exchange that gives the farmers access to vital market information about harvests, prices, marketing, and other information that allows them to gain the highest return for their crops (“AGRA”). The creation and use of local storage and processing facilities would also reduce costs for farmers by limiting the amount of post harvest losses and providing them with the ability to process their crops locally. Furthermore, improving the now poor transportation links between different locations will enhance a farmers ability to sell crops further from home, potentially increasing profit. Currently, due to the poor quality of surface roads and trains, transportation costs for farmers are unreasonably high, limiting their ability to sell their surplus harvest (Basu).

The benefits of modified seeds have the potential to significantly decrease food insecurity in Rwanda through a variety of means. First, through a process called “biofortification,” new varieties of staple food crops can be bred to be rich in nutrients that would otherwise not be provided in a typical diet (Islam). Currently, 56 percent of children under the age of five are anemic, but with the availability of iron-rich beans this condition could be easily fixed (“Malnutrition”). Vitamin A is generally missing from the diet of many Rwandans, but enriched maize and sweet potatoes can provide this essential nutrient (Islam). Another benefit of genetically modified seeds is the reduction of herbicide use, which reduces costs for farmers and makes farming more environmentally sustainable (Strauss). One of the most profound benefits of improved seeds, is the ability of farmers to produce more crops on the same plot of land. Due to disease, drought, and insect resistance, the given yield for a farm using genetically modified seeds will increase their previous yields up to four fold (“AGRA”). This will allow farmers to produce a surplus of food, some of which can be sold to earn income that can be reinvested in the farm.

As a farmer’s profits grow, he can then begin growing cash crops such as coffee or tea, invest in expanding and improving his farm, and improve the quality of life for his family. The increase in income would also provide the opportunity for more children to buy uniforms and books, allowing them to attend school. Eventually these children will grow and inherit their parents’ farmland, and these children will become farmers themselves. Their education will be advantageous in that it will not only be used to continue the process of improving farms, but also in creating more advanced seeds, better strategies for conserving soil nutrients, and preventing erosion. Increased income and education will also lead to more diversification of jobs, allowing sectors such as industry and higher education to become more active. In a country with half its population under the age of eighteen, education is increasingly important to provide these children with the skills and knowledge that will allow them to find good jobs when they finish school (“Rwanda” CIA). The improvement in education would also serve to reduce malaria in succeeding generations through education about mosquito nets. It would also reduce the occurrence of HIV and AIDS through education about safer sex practices. Higher income would increase the accessibility of general health care, which is lacking for most rural Rwandan families.

The profits from farming with improved seeds will also bring benefits to the community at large. As farms become more productive, the need for better access to water, improved new seed storage and production capacity, will increase. And with higher income, farmers will be able to invest in these developments (“AGRA”). Eventually, too, the demand for seeds will allow for new seed companies and cooperatives to emerge and be viable in the seed market. In fact, in other areas of Africa that have already made strides towards implementing nationally produced modified seeds, the existing companies consistently sell their entire stock and cannot keep pace with demand (“National”).

The success of eliminating food insecurity also depends on future changes and Rwanda’s ability to adapt to shifting environmental and economic conditions. Already the most densely populated country in Africa, its roughly the size of Vermont but has a population almost seventeen times its size (“Vermont”). In the coming years, it will only continue to grow. This will reduce the amount of arable land and will place a heavy burden on farmers to produce more food. The current solution to this is over-planting which only confounds the problem by causing the available farmland to erode even faster (Strauss). If improved seed varieties are implemented throughout the region this would provide relief for this problem now and in the future. Since the higher-quality seeds have the ability to produce much higher yields, existing land will be able to produce more using the same fields as before. The reduction of over-planting will also be important in conserving the land that is available by reducing the effects of soil erosion. The use of improved plant varieties with higher drought resistance will also be important to Rwanda’s future as climate change makes the weather conditions even more unpredictable. A genetically engineered plant revolution is needed as a means for providing a rapid response to the imminent threats of both population pressure and changing weather, which will only worsen as time goes on.

In addition to the local government, banks, and investors that will be needed to provide credit and start-up capital to farmers and agro-dealers, many other factors will need to be in place in order to introduce genetic technology to Rwandan farmers. Outside nations, NGOs, and aid agencies could benefit Rwandan farmers by providing the finances needed to obtain loans and credit in order to invest in farms, seeds, or emerging agricultural companies. Providing services such as enhancing or building new infrastructure that allows farmers easier access to markets could also be beneficial.

One method of aid that should not be used, however, is the provision of free seeds to farmers (Chu). A consequence of this action could be to depress prices of nationally produced seeds, harming the companies that sell them, as well as the local agro-dealers. In most cases the seeds given as aid are for crops that are not specifically suited to the region where they are distributed. Instead of donating seeds, a better contribution from established breeding companies would be the investment of time and expertise, which would allow Rwandan companies to produce more technologically advanced and environmentally sound seeds. Any organization whose goals are associated with more environmentally and productively sustainable farming practices would be welcome to provide smallholder farmers with the information they need in order to operate their farms in an environmentally conscious and positive way. And although it is not directly associated with agriculture, aid in the form of affordable healthcare clinics would be especially helpful in the fight against poverty, as staying healthy is one of the most difficult problems many people face (Donovan). Eventually, as Rwanda gradually moves towards greater food security, the roles of these international entities would become less crucial to Rwandan development. They could then be gradually phased out of the country until it is entirely self-sufficient and there has been a vast reduction in the number of people suffering from poverty. Overall, the best way for a foreign organization or company to provide aid to Rwanda is to treat it as a normal economy

instead of giving charity (Chu). This type of involvement will be more beneficial in the long-term than any other form of support they could provide.

With the help of outside actors, as well as dedicated scientists and producers, Rwanda has the ability to significantly improve the lives of millions of its citizens. Through the use of enhanced crops, farmers can begin to move away from simple subsistence agriculture towards surplus yields and the production of cash crops, allowing the farmer to expand into broader markets. As rural Rwandans find themselves gaining more capital, there will be myriad outside results that extend beyond food security. The growth of agricultural and other industries will spark progress in other industries as well as in areas such as healthcare and higher education.

Even if Rwanda receives all the assistance it needs to implement the use of improved plant varieties, the burden ultimately rests on the shoulders of the smallholder farmers, the heart of Rwanda's agricultural community. It is up to these men and women to look to the future and realize that the quickest and most advantageous way of growing crops is through the use of genetically modified seeds. These farmers must make the decision to switch to the available high-quality seeds and continue to use them in their fields. In order to be even more successful the rural farmer must, above all, be willing to learn and adapt to a changing world that can provide the tools needed to overcome poverty and food insecurity. Like the farmer, Rwanda too can break free from the crippling poverty and hunger that define the country today and instead focus resources and attention on growing into a more economically sound and developed country.

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