

Vishal Chandra
Totino-Grace High School
Fridley, MN
Bangladesh, Factor 11: Malnutrition

The Golden Rice Project: addressing vitamin A deficiency in Bangladesh

The United States spends more than \$5.3 billion in assistance to health programs in foreign countries: a third of their foreign aid budget. Although this is a relatively small part of the overall budget, one would expect at least some definitive progress in the quest for reducing food insecurity in developing countries. But the problem in attaining any part of this goal lies in the previous sentence itself. Ongoing efforts to innovate can lead to better opportunities in improving the collective health of people in places like Africa and Southeast Asia. Bangladesh, on the eastern border of India, is one of the most densely populated countries in the world and has one of the highest vitamin A deficiency rates. One in five preschool age children are deficient in vitamin A, leading to blindness and stunted development. Women who become pregnant are also at high risk for giving birth to a child that may suffer negative effects. For affected people, the stakes are high. To realize what needs to change in our approach, analyzing a modern solution that complements different aspects of a particular third-world country is essential. The Golden Rice Project has many features that make it specifically suitable to the economic, environmental, and social characteristics of a country like Bangladesh.

Rice naturally does not have vitamin A. Beta-carotene is an orange colored pigment that is converted to vitamin A when consumed. This vitamin helps keep our eyes healthy and plays a role in development of skin, bones, and immune functions. Combining beta-carotene in to the bio-structure of a rice grain, an example of biofortification, is the basic concept of the science behind the Golden Rice Project. Before, only plants and leaves possessed the ability to accept this nutrient into its system, while rice grains did not. But with the addition of two genes, a plant phytoene synthase and bacterial phytoene desaturase, a pathway is formed in which beta-carotene can accumulate in the rice grain.

The World Food Prize is an international award presented to specific individuals who have advanced human development by improving quality, quantity, or availability of food in certain parts of the world. The 2016 recipients of this award were credited with the development of biofortification and its application to third-world countries. The ability to not only genetically modify provisions in a country, but also to apply it to a staple food crop is such an essential aspect of coming up with a better solution. This is how a progressive project idea takes its place. The science behind the Golden Rice Project is a branch of biofortification that combines science and practicality in its mission to provide an empowering and self-sustained result. In 1999, a breakthrough occurred in which the modification of genes in rice grains was made possible. This was followed by further development and, eventually, an implementation phase.

A typical household in Bangladesh is comprised of both a nuclear and extended family and, therefore, is usually of a larger size. The society is particularly male dominated, even in comparison to other parts of the eastern world. This is the case in most households as well. The average literacy rate for the total population is only about 43.1 percent (Wikipedia). In contrast to men, women are expected to stay at home and are of low status. More well-off families can afford apartments in cities, but most of the rural population lives in poorly constructed huts.

Bangladesh is divided into regions. Each region is organized into six divisions. However, government structure in rural areas has been altered to a system called the “four tier” local government. This consists of the village, union (collection of villages), upazila (sub-district), and zila (district) council. The goal of this concept is to acquire helpful input from every level of society so that bias in the governing of people can be minimized. This type of organization gives the agrarian part of the population a bigger say when it

comes to deciding on topics affecting self-sustaining agriculture and maximizing the quantity and quality of the output.

Two-thirds of the rural population is directly employed in agricultural work, and makes up 77 percent of the country's workforce (World Bank). Most agrarian families rely on the cultivation of land for income, and their work has accounted for 90 percent of the poverty reduction from 2005 to 2010 (World Bank). This form of self-sustenance is dependent not only on the availability of land, which does not seem to be a problem, but the amount and location of rainfall. This acts as a major barrier for rural families who are increasingly using these agricultural practices to sustain their livelihood.

Generally, the rural population does not live as well as the city dwellers. Along with non-reliable shelter, an inadequate environment also plagues rural Bangladeshis. The problem of rainfall leads to the question of how agricultural output is affected. Many crops such as rice, wheat, sugarcane, tobacco, different vegetables, spices, and tea provide agrarian families with modest nutrition and are reasonably sustainable. However, there is a saying, *Machh-e-bhat-e-Bengali*, which means, "Fish and rice make a Bengali." Rice is abundant, and so are fish in the many rivers that pass through Bangladesh, but neither of these food sources give people the amount of micronutrients they need. The main problem is not that there isn't enough arable land, but that the outcomes don't give adequate nutrition. A staple of the Bangladeshi diet, fish is a good source of protein as well as of vitamin A. However, generally speaking, it does not by itself provide enough vitamin A in the diet. Rice is even more a staple of their diet, but it does not naturally provide vitamin A. Biofortification of the rice offers a modern solution to this problem. This is a primary issue that The Golden Rice project addresses.

Despite limited transportation and a ruthlessly hectic environment, access to education for children in Bangladesh has opened up significantly. Quality for all levels is something that cannot be assured, but drop out rates have decreased, and free admission for elementary school relieves stress on families.

With the dense population throughout the country and the responsibilities of larger families, appropriate health care becomes a challenge. Seventy percent of the population is located in rural areas, but most health workers are concentrated in urban hospitals and clinics. Accordingly, the over-centralized system leads to an uneven distribution of health care. For every 10,000 people, there is an average of only 3.05 physicians and 1.07 nurses (Global Health Workforce Alliance). Also, there is a lack of sanctioned health workers to properly guide people in need, leading to an even deeper concern. Twenty eight percent of treatments administered in government healthcare facilities are of alternative medical practices (Global Health Workforce Alliance). With these unstable conditions, things have gotten worse. As of June 2011, there was a 50 percent shortfall even in alternative medicine providers (Global Health Workforce Alliance).

In contrast to the discouraging message of health care delivery, there is an optimistic viewpoint that can be drawn from the current standards. It starts in the rural villages and comes from recognizing that self-sufficiency is more reliable than dependency. Undoubtedly, people need health care, and health care facilities need people. It is a direct relationship. But, when quality of health care is insufficient and the population relatively large, there is little hope for the ill or poor.

Utilization of the Golden Rice Project in a country like Bangladesh has the potential to become fairly significant when considering certain factors. Bangladesh is along the Bay of Bengal and has two rivers flowing into the country from the northwest, and two incoming from the north. Because the topography of the land consists of mostly low-lying plains, it is especially susceptible to flooding during the monsoon seasons (from May to September). However, the area is suitable and useful for rice cultivation. Rice production in Bangladesh accounts for about 75 percent of agricultural land use (Wikipedia). But, steady increases in output have barely kept up with the rising population. The goal of the Golden Rice project is

to maximize the amount and quality of rice production while adapting to the environment, economy, and social aspects of Bangladesh.

When someone mentions rice, people think of Asian countries and mass production. Mass production of a staple food crop in Asian countries all depends on the factor of environment, and so does the idea of the Golden Rice Project. Because of a mostly rural population, Golden Rice would fit well in the agricultural society of Bangladesh. The question is not whether the area is suitable enough, but whether there is availability of enough land and how this impacts the economy and views of the majority.

This project itself is very cost-efficient to a country like Bangladesh. In contrast, a rather expensive investment they have made is underground irrigation. This involves channeling water from monsoon rains to crop fields. To some extent, this assures more reliability in production, but practically all output is consumed within the country. Being one of the poorest areas in the world, the absence of exports in agricultural yields is of no help to the economy as a whole. Nearly all the rice crop grown is consumed by Bangladeshis themselves; there is little or no rice left to export. Implementation of Golden Rice will have an indirect yet definite effect on the economy. Success in rice production is more likely to succeed because of two reasons. First, the rice grown is an adaptation of boro rice (indigenous to rural Bangladesh). Secondly, success in decreasing overall deficiencies in vitamin A could provide a larger and healthier workforce that is more productive. Ideally, this should lead to a 10 percent increase in rice yields that would benefit farmers by 163 billion takas, the national currency (Copenhagen Consensus). A healthier workforce results in greater yields, and thus the opportunity to export the surplus rice. For every taka spent on Golden Rice there is a 416 takas worth of health and productivity combined benefit (Copenhagen Consensus).

Bangladesh was the leading exporter of jute fiber in the world, but the once lucrative industry has now diminished. Golden rice is a food source whereas jute is a vegetable fiber used for manufactured goods rather than as a source of nutrition. Accordingly, a recommendation to consider is allocating some of the land used for jute production for Golden Rice cultivation instead. Land availability is an important consideration when it comes to this Golden Rice project. Considering how arable the land already is in the jute fields, conversion to rice cultivation would be relatively easy. Although the need for workers to be retrained to farm rice rather than jute poses a challenge, it is not likely to be an insurmountable one because of the general familiarity with, and relative simplicity of rice cultivation.

Lands that still produce an average or excess amount of jute can be preserved to sustain productivity of the business. After all, the “golden fiber” has been a sign of prosperity and a significant source of income for the country in the past. However, besides the fact that jobs in this field are still essential for the poor to earn a livelihood, there is no reason to devote so much land in the continuation of jute production. Some of that land could be used for Golden Rice cultivation and thus allow greater quantity and quality of food for the growing population. By increasing overall health, increased production may very well ensue. For Bangladesh at this time, a surplus in food crops is more valuable than a surplus in jute.

Another recommendation focuses on the social adjustment in Bangladesh. The Golden Rice Project could increase overall unity among the people. They will realize that in order to regain the ability to consistently support their land, an initial push needs to be provided. But, with respect to their pride and desire for independence, the project creates a sense of hope by giving them an ongoing industry. Indirectly, it appears that the project also helps to support the Bangladeshi culture by making the genetically modified rice look similar to an Indian dish called saffron rice (which has a comparable tint of yellow). This could lead to further support of the project.

The science behind biofortification and its implementation in modified rice grains may be beyond what the general population of Bangladesh can understand, or wants to understand. The idea of putting something into one's body that has been genetically modified can be difficult for some to accept. The

question of whether it is wise or not cannot be answered by the promoters of the Golden Rice Project alone. When it comes to biofortified crops, HarvestPlus, an organization overseeing the high-zinc rice project in Bangladesh has a similar mission to that of the Golden Rice Project: solving a huge problem without interfering with tradition. As the population begins to fully realize how big of a problem malnutrition is in the country, people will understand that the goal of organizations such as the Golden Rice Project and HarvestPlus is to ultimately help Bangladesh and its people in the best way possible.

Today, commercial consumers look for the most advanced products in every market such as the most up to date iPhone or the latest video game. Many manufactured goods only appeal to the temporary happiness and stress-relief people seek in everyday life. However, every consumer item is constantly being replaced by an even better one. This same concept also applies to crops, which support the very health of the consumer. Modern change is what drives the world forward, but not every country can afford to focus on the improvement of commercial products. A workforce that can power the economy, a cooperative population, and optimal use of environmental conditions is the key to helping Bangladesh emerge as a middle-income country. Our responsibility to aid a country like this stems from the fact that we have the resources and ingenuity to do it. The Golden Rice Project effectively adapts modern science to a society that is accustomed to self-sustained agriculture, and also contributes to their sense of pride through self-sufficiency. This is what the population of any country needs to have in order to thrive. By improving the nutrition of the Bangladeshi people, the success of the Golden Rice Project could contribute to the improvement of the nutritional status of world society as a whole.

Bibliography

- "Agriculture." *Agriculture - Banglapedia*, 23 Mar. 2016, en.banglapedia.org/index.php?title=Agriculture. Accessed 14 Apr. 2017.
- "Agriculture in Bangladesh." *Wikipedia*, Wikimedia Foundation, 4 Apr. 2017, en.wikipedia.org/wiki/Agriculture_in_Bangladesh. Accessed 14 Apr. 2017.
- "Bangladesh." *Countries and Their Cultures*, www.everyculture.com/A-Bo/Bangladesh.html. Accessed 14 Apr. 2017.
- "Bangladesh." *WHO*, World Health Organization, www.who.int/workforcealliance/countries/bgd/en/. Accessed 14 Apr. 2017.
- "Bangladesh." *Worldmark Encyclopedia of Nations*, Encyclopedia.com, www.encyclopedia.com/places/asia/bangladesh-political-geography/bangladesh#ECONOMY. Accessed 14 Apr. 2017.
- Jorge Mayer. "Golden Rice Project." *The Golden Rice Project*, www.goldenrice.org/index.php. Accessed 14 Apr. 2017.
- "Golden Rice: the Crop That Promises Incredible Benefits in the Fight against Malnutrition." *Golden Rice: the Crop That Promises Incredible Benefits in the Fight against Malnutrition | Copenhagen Consensus Center*, www.copenhagenconsensus.com/bangladesh-priorities/golden-rice-crop-promises-incredible-benefits-fight-against-malnutrition. Accessed 14 Apr. 2017.
- "Jute Cultivation." *Wikipedia*, Wikimedia Foundation, 26 Feb. 2017, en.wikipedia.org/wiki/Jute_cultivation#Strengths_of_major_jute_producing_countries. Accessed 14 Apr. 2017.
- Noll, Daniel, et al. "Bangladeshi Food: An Overview." *Uncornered Market*, 5 Mar. 2017, uncorneredmarket.com/bangladeshi-food/. Accessed 14 Apr. 2017.
- "Office of Dietary Supplements - Vitamin A." *National Institutes of Health*, U.S. Department of Health and Human Services, ods.od.nih.gov/factsheets/VitaminA-HealthProfessional/. Accessed 14 Apr. 2017.
- "Bangladesh Jute Industry in Decline." *Bangladesh Jute Industry in Decline – Al Jazeera English*, www.aljazeera.com/news/asia/2008/12/2008121035022494523.html.
- "ILO." Jute Means Jobs in Bangladesh, 17 Aug. 2016, www.ilo.org/dhaka/Informationresources/Publicinformation/features/WCMS_511710/lang--en/index.html.

