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Nicaragua, Factor 11: Malnutrition

### **Nicaragua: Bio-Fortifying Perennial Crop Plants**

Nicaragua is the second poorest country in the Western Hemisphere. Its unemployment exceeds 20 percent among the rural poor. It was ranked 21st out of 79 on the 2012 Global Hunger Index ("Nicaragua | Food Security Portal."). Poverty is a prevalent problem in Nicaragua due to half of its population living in rural areas, there is limited infrastructure and farmers are unable to access markets and new technologies. A large percent of rural families depend on agriculture for their livelihood, but the lack of important resources such as water and fertile arable land makes it hard to produce nutritious food. Families in Nicaragua have a strong dependence on a few main crops such as sorghum, maize, and beans. The limited diversification of crops makes rural households vulnerable to the variations of market prices and sporadic weather events. Recent fluctuations in crop prices and droughts have increased poverty in several regions and affected large areas of cropland. An estimated 19 percent of the population was thought to be malnourished in 2007 and 23 percent of children under the age of five suffer from chronic undernutrition ("Nicaragua | Food Security Portal."). Nicaragua should implement a perennial crop biofortification breeding program to produce sustainable crop varieties adapted to local conditions and able to provide more nutrients.

In Nicaragua, a typical family is a patriarchal one where the father is in charge of the household and makes all the decisions. Even in circumstances where the father does not live with the family or is not around, he is still influential and his presence is felt. His affection is fostered by the mother. The fathers are not around because the farms are several miles away from the homes and normally are working on the farms all day while the mothers take care of the children and households. The family consists of 5 children, a mother, and a father that may not always be around. The diet of the family consists mostly of white corn, beans, garlic and onions because they can be locally grown and they are plentiful. Nicaraguans consume corn tortillas with most meals. Nicaragua's version of the tortilla is large, thin and made of white corn. They usually fill it with meat and beans like a soft-shelled taco. Beans are eaten daily as a main source of protein because most people cannot afford to eat meat regularly.

Nicaragua's education system is weak due to the government's inability to fund it properly. Schooling is free and required for children ages seven to twelve, but 30 percent of primary age students are unable to attend classes. The family needs the children to help take care of the farm. Lack of education hurts their productivity on the farm and contributes to the high unemployment rate. Health indicators show gradual but steady improvements ("Nicaragua."). Nicaragua has improved access to services such as clean water and sanitation facilities. Qualities of health have improved such as prolonged life expectancy, decreased infant/child mortality, higher immunization rates, and increased child nutrition. Despite this progress there are still large discrepancies in access to and quality of health services across different groups and regions such as poor individuals living in rural areas, the indigenous population, and individuals living in households engaged in agriculture. These groups have limited access to health care services and preventive care.

Farms in Nicaragua range in size from small, self-sufficient family farms that are usually less than 10 acres in size to large plantations that produce crops for export. The significant amount of crops grown are sugarcane, corn, rice, bananas, and coffee. The livestock is beef, lamb, chicken, veal and pork. The agricultural practices include conservation and recovery of soil and water, use of natural insecticides, crop diversification, and reforestation efforts. The government is also trying to assist farmers who are making the transition from using pesticides and synthetic fertilizers to organic, sustainable agriculture.

Barriers to improving agricultural productivity are low productivity in Central American economy. More productivity is what producers and exporters in the Agricultural Sector in Central America need to achieve if they want the competitiveness of their products to be not only maintained, but increased. The agricultural sector is demanding a law that grants tax benefits and allows the use of leasing of machinery and equipment to improve competitiveness. Instead of buying equipment and financing it with a bank, the agriculture sector is calling for a law to be approved to regulate and encourage the use of leasing, as a way to improve productivity by renting equipment and not borrowing to acquire it. Borrowing equipment is a way for farmers to save money on equipment but it declines the amount of productivity because it only allows one farmer to have the equipment at a time.

Obstacles to employment at a living wage are a relatively high level of legal minimum wages compared to average wages, which means that minimum wages have the potential to affect a large fraction of the population, substantial variation in minimum wages both across industries and over time, a large proportion of private sector workers not legally covered by minimum wages (the self-employed), and a large sector of small firms where employers often avoid minimum wage legislation. Nicaragua has a law that states that you have to make about \$121 per month. Nicaragua workers who lose covered sector employment because of higher minimum wages are likely to become unpaid family workers or leave the labor force (and not become self-employed or unemployed). There seems to be a higher share of unpaid family workers whereas the average income looks lower. Many people are surprised by the number of workers in Nicaragua earning less than the minimum wage, even in the large firm sector. Also, the share of full time uncovered self-employed workers earning less than the minimum wage is substantially larger than the share for all self-employed workers (including part-time workers).

Obstructions to accessing food markets and adequate nutrition include that many people live in rural areas which prevents them from accessing or having the means to access food markets in the urban areas. A large percentage of the population in Nicaragua is in poverty which prevents them from getting the proper food that they need. The staple food prices are staying the same while the non-staple food face inflation but they are also high in nutrients so many people don't get the vitamins and minerals they need. The families cannot afford adequate nutrition. The main causes of the nutritional status are due to the short duration of exclusive breastfeeding and early introduction of food and other liquids that satiate the hunger but do not nourish the body. In addition to the deficient consumption of dietary energy and protein, the poor rural population suffers other deficiencies as a result of an insufficient intake of products of animal origin and other sources of iron and vitamin A, such as the fruits and vegetables. This situation is attributable to problems of food access due to low levels of income. The employed population is low in relation to the open unemployed population, which severely affects levels of development and food security.

More than 17 percent of the population of Nicaragua is malnourished ("The Global Food Security Index."). Many families have trouble getting food so that limits the solutions for malnutrition. Malnutrition is increasing as more people fall below the poverty line. With malnutrition improved, farmers would be able to work longer, be healthier, be more productive, and save money. Climate change and water scarcity will affect malnutrition because crops will not be able to cope with the changing environment. There is an abundance of fresh water but people don't have access to safe water. Since there is a changing climate, plants will be less nutrient dense. The crops will be lacking key nutrients that help people to survive and be healthy. To combat malnutrition, Nicaragua should invest in breeding perennial crops with high amounts of vitamins and minerals.

Perennial crops have the advantage in that they protect the soil from erosion and do not need to be planted year after year. The perennial crops can handle drought for a longer period of time because of its extensive root system. Many agricultural programs are breeding perennial crops such as perennial wheat, sorghum, rice, chickpeas, millet, corn and beans. These crops will help prevent the prevalent iron, vitamin A, and zinc deficiencies. A very low increase in pulses, dietary foods required to be healthy that are nutrient rich, causes deficiencies. Vitamin A deficiency causes 375,000 children to go blind each year and supplements reduced child mortality by 23 percent ("The Global Food Security Index."). Iron deficiency causes impaired cognitive skills which cannot be reversed. Zinc deficiency causes increased incidence, severe diarrhea, pneumonia, and stunting and affects 2 billion people. By breeding plants to be high in Vitamin A, Zinc, Iron and other important nutrients would provide needed nutrition to the Nicaraguans. If genes needed to introduce vitamins are not found in the crop germplasm genetic modification can be used.

Genetic modification or bioengineering is taking a single or multiple genes of an unrelated species and putting it in another species and possibly crossing the species barrier to have a desired trait expressed. The benefits of genetic modification is the ability to breed varieties faster to get a desired trait, unwanted genes are not included in the process, and new traits can be introduced that are not from the original gene pool. Some limitations of genetic engineering are the possibilities of new allergens being introduced and of genetic drift to ancestral species. Harvest Plus is an organization which researches bio-fortification in staple crops. By collaborating with Harvest Plus and similar organizations, plant breeders in Nicaragua can learn how to increase the vitamin and mineral content in crop plants.

The bio-fortified crops will be bred by crossing related perennial species with annual grain crops. The steps to cross the plants are choose parents, emasculate female, bag female and male, take pollen from male and put on female, wait until seeds mature, collect seeds, regrow grow seeds, evaluate over a period of years, and introduce varieties. Once the seed has been developed and trialed to yield on average, similar or more than native crop varieties. The seed will have to be able to be grown out and stock increased. The seed stock will be increased by distributing seeds to paid farmers in order for them to grow out the seeds, having the farmers distribute it back to the breeders, keeping half of the bushels to be grown out, and distributing half the bushels to farmers for trials. Once enough seeds are grown out and trials are conducted the seeds will be distributed using a germplasm exchange, which is taking improved varieties of seeds and exchanging them for the local varieties that the farmers have. A germplasm exchange will preserve the genetic diversity of the crops and it allows for plants breeders to cross unique

traits into high yielding varieties that some low yielding crops have. The seeds can potentially be used later to combat diseases and pests.

Seed sellers should be able to acquire the improved seed to sell to local farmers. Farmers will then be able to grow out the perennial crop with the assistance from local agricultural agents. The farmers will then be able to access food high in vitamins and minerals to alleviate malnutrition in Nicaragua. If the farmer has enough produce to sell to locals, other families can have access to local food and support the local economy. An important aspect to the quality of nutrients, is storage of the crop. Nutrients in the crop could degrade if it is not stored properly. Simple improvements to the storage of the crop will improve the nutrient quality. In order to preserve the vitamins and minerals in legumes like chickpeas, they could hang them to dry and then separate chaff from seed. They could hang from a lean-to or shed to keep the legumes off the ground, prevent rain damage, mold, and rodents. As long as it has a roof, it could be added to an existing building. To prevent the degradation of nutrients in corn they could shell them and put them in plastic buckets with lids, solar powered grain bins or miniature grain bins, as long as they are kept dry. Perennial bio-fortified crops could alleviate many nutrient deficiencies in Nicaragua and across the world.

By breeding perennial bio-fortified crops, Nicaragua will be able to lower its malnutrition rate and produce sustainable crop varieties that are adapted to the local climate. The crops in Nicaragua lack many nutrients such as vitamin A, zinc, and iron and cause many deficiencies. Lack of education hurts their productivity on the farm and contributes to the high unemployment rate. The poor economy, the high poverty rate, and access to food markets and adequate nutrition are all barriers to improving malnutrition. Due to the economy, it is hard for farmers to purchase seeds and equipment. Nicaragua's malnutrition problem will be impacted by climate volatility and water scarcity. A solution to the malnutrition is a breeding program that adapts to the climate problems and is economically friendly as well as able to provide more nutrients to the crops. Perennial crops can help adapt to these problems and are a highly probable candidate to sustainably feed Nicaraguans. Another solution is implementing grain bins to solve storage for the crops. By breeding perennial bio-fortified crops using traditional and genetically modified plant breeding we will be able to sustainably feed and give nutrients to the developing world.

### Works Cited

- Alaniz, Enrique, T. H. Gindling, and Katherine Terrell. "The Impact of Minimum Wages on Wages, Work and Poverty in Nicaragua." May 2011. Web. <<http://ftp.iza.org/dp5702.pdf>>.
- Diego Angel-Urdinola, Diego, Rafael Cortez, and Kimie Tanabe. "Equity, Access to Health Care Services and Expenditures on Health in Nicaragua." May 2008. Web. 13 Mar. 2016. <<http://siteresources.worldbank.org/HEALTHNUTRITIONANDPOPULATION/Resources/281627-1095698140167/CortezNicaraguaHealth.pdf>>.
- "Granada's Market / Mercado Municipal, Granada, Nicaragua." *Have Camera Will Travel People Places*. Web. 28 Mar. 2016. <<http://havecamerawilltravel.com/market-granada-nicaragua/>>.
- Kinsinger, B. "Agriculture in Nicaragua." Speech.
- "Minimum Wages in Nicaragua with Effect from 01-09-2015 to 29-02-2016." *WageIndicator.org*. Web. 28 Mar. 2016.
- "Nutrition Country Profiles: Nicaragua Summary." *Nutrition Country Profiles: Nicaragua Summary*. Web. 10 Mar. 2016. <[http://www.fao.org/ag/agn/nutrition/nic\\_en.stm](http://www.fao.org/ag/agn/nutrition/nic_en.stm)>.
- "Nicaragua." *Culture of*. Web. 28 Mar. 2016. <<http://www.everyculture.com/Ma-Ni/Nicaragua.html>>.
- "Nicaragua | Food Security Portal." *Nicaragua | Food Security Portal*. Web. 28 Mar. 2016. <<http://www.foodsecurityportal.org/nicaragua/indicators>>.
- "Rural Productivity in Central America." *Central America Data*. Web. 19 Mar. 2016.
- S. (2015). Global Issues in Agriculture Series: "Better Crops, Better Nutrition: The Power of Biofortification" Retrieved August 08, 2016. <[https://www.youtube.com/watch?v=eCFXu\\_WgaN4](https://www.youtube.com/watch?v=eCFXu_WgaN4)>.
- "The Global Food Security Index." *Global Food Security Index: Country Profile*. Web. 28 Mar. 2016. <<http://foodsecurityindex.eiu.com/Country/Details#Nicaragua>>.
- "The Nicaraguan Family In A Time Of Transition." *Revista Envío* -. Web. 28 Mar. 2016. <<http://www.envio.org.ni/articulo/3853>>.

