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Jatropha: A Potential Biofuel for Poor Farming Families in Haiti

Energy is a leading issue for consumers, businesses, environmentalists, and politicians today. A primary reason for the concern is the dramatically rising demand for energy globally, especially from fossil fuels. In the past five years, the world-wide consumption of oil has increased from 76 million barrels per day (bbl/d) to 80 million bbl/d. Each barrel is 42 gallons of crude oil making that a 168 billion gallon difference from the years 2002 to 2007. The rising demand for oil in the United States, as well as in developing countries like China and India, has dramatically increased the cost of oil on the world market. In May 2007, the United States spent $61.38 per barrel of crude oil compared to the lower price it paid in May 2004 at an average of $33.80 a barrel. This price has almost doubled in just three years. The rising cost of oil, as well as a need for cleaner-burning fuels and the need to reduce dependency on Middle Eastern oil, has driven researchers to look for alternative sources of energy. Several possible alternative sources of energy have been identified, including nuclear, solar, hydroelectric, and wind energy. It is important that an alternative fuel be economical, clean, easy to produce, abundant, and safe. Unfortunately, there are drawbacks to all of the energy sources cited above. Consequently, researchers have searched for other alternatives--notably, biofuels. As the term "bio" suggests, biofuels are fuels that consist of or are derived from biological matter such plants or animal waste. They may be liquid or gaseous in form and may be burned to produce heat, electricity, or mechanical force as in the case of a biodiesel engine. The biofuels of greatest interest in the U.S. are ethanol (a form of alcohol), organically derived oils and fats (biodiesel), methane, and hydrogen. These fuels are appropriate for developed countries that have the technology to produce and use them. However, they will not be appropriate or of interest to underdeveloped countries for a variety of reasons. Now take a look at one poorly developed country--Haiti. Although Haiti has a unique history, culture, and geopolitical environment, it shares several features with other poorly developed countries. For example, like many poorly developed countries it possesses a large, poorly educated population that survives on low-technology, subsistence farming. As such, Haiti, like many other poorly developed countries, faces different challenges in solving its energy problems than do more well-developed countries. They constitute the majority of the population (i.e., 75%). It will be their needs and circumstances that will determine if a possible biofuel solution will be identified and proposed.

Haiti, or Ayiti as the native peoples, the Tainos, called it, is a country the size of Maryland and is located on the island of Hispania in the Caribbean. Haiti takes up the western third of the island; the Dominican Republic takes up the remainder of the island. Haiti also consists of several small islands, including La Gonâve, La Tortue, Les Cayemites, Ile de Anacaona, and La Grande Caye. Overall, the country spans approximately 10,600 square miles of predominantly rugged, mountainous terrain. Only about 20% of the land is considered suitable for farming. The official languages are French and Creole. Both are taught in the schools. The Gross Domestic Product (GDP) of Haiti, an estimate of the total economic productivity of the country, is $12.9 billion. By comparison, the GDP of Maryland is $246 million. Haiti's major industries are sugar refining, flour mills, cement, and textiles.

Haiti has a population of almost 9 million people and approximately 21% of the population is considered to be upper class, but they control 44% of the national income. Most of the individuals in the upper class are educated and many are employed in the government or have earned their wealth in businesses. The creation of a professional military and additional government-supported services have paved the way for a small but growing middle class. Middle class individuals are typically not employed in occupations that involve manual labor, have moderate incomes, and are literate in French. They also typically wish to improve their social standing by seeking education for themselves and their children and

by living in cities where there are better economic opportunities. The bulk of the population, though, are poor and live rurally. It is clear that this population would benefit the most from improvements in agricultural practices and output. It should also be noted, though, that there is a significant proportion of the lower class that live in the major costal cities and the country's capital, Port-au-Prince. The poorest among the urban lower class live in some of Haiti's worst sanitary and health conditions. It is possible that an improvement in the living standards of poor Haitians living rurally would encourage more of the urban poor to seek better conditions in the countryside.

Historically, Haitians have suffered serious political instability that has certainly impeded the economic and agricultural development of the country. Haiti became known to Western civilization when it was discovered by Christopher Columbus in 1492. Columbus befriended the local inhabitants who traded gold to the Spanish. However, whether it was greed fueled by the presence of gold and/or other influences, the discovery of Haiti by the Spanish was ill-fated for the Tainoan civilization. By the mid-1500's the Spanish had destroyed it. Then, by the late 18th century imperial France had made Haiti a French colony. The French brought slaves from Africa to work on the plantations, which dramatically changed the demographics of Haiti. The slaves became the majority of the population, and today their descendants remain the dominant racial group in the country. In 1791, the slaves revolted against the white government and fought for more than ten years before winning the independence of their country from the French colonists on January 1, 1804. Subsequently, the country was ruled by a series of dictators until February 7, 1991. After 186 years of dictatorships, the Haitian people elected their first president. Hence, Haitians have enjoyed democracy for only a little more than fifteen years. The significance of a democratic government is that it is more likely to provide a political environment favorable to economic development including agricultural development for the rural Haitian families.

The typical rural Haitian family is composed of two parents and between seven and eight children. The family structure which used to be a lakou, a term for the cluster of houses where extended family lived, has since disintegrated due to disputes over land ownership and inherited plots that have been split over the generations. Although the families do not stay as close in modern days as in the past, they still rely on each other for support. Sometimes contacting the extended family can lead to land disputes so the Haitians do not always contact family.

For a typical rural family the average calorie intake per person is 1,300 calories. This is a 1,200 calorie deficit for the Haitian male on a 2,500 calorie intake average for the adult male and a 500 calorie deficit for the Haitian female on a 1,800 calorie intake average for the adult female. The diet of a Haitian is mainly rice and beans because they are easier and cheaper for the family to attain. On feast days if the family is lucky, they may have chicken. For the farm family there are only two meals a day, a morning and an evening meal. If there ever is a lunch it is more like a midday snack that consists of fruit or sugar cane. One Haitian is reported to have said "You eat what you find in the gardens". The gardens is a Haitian peasant term for their farmland.

As a way to climb the ladder of social heirchy, education is very important to a Haitian, but for a rural family it is very unlikely for them to be able to send their child to school. If the child does attend school, most of the classes are in literature ad the humanities. There are some classes that are offered in the secondary schools that are based on vocational education and agriculture. To get into a secondary school the child must first pass an entrance exam. The high cost needed to pay school fees is a barrier that stops many Haitians from sending their children to school. The money that is earned throughout the year is used on necessities; even falling short on the amount needed for food, leaving none left for a child to go to school. Even if the money was available; location of the school is also a huge issue as most schools are too far away to consider attending. The family's total income for the year is around $300 to $400 American dollars. With money spent on seeds for crops and irrigation, there is little money left over

for food and sometimes education. Most of a farmer's income is made by working as a laborer in the fields for the Dominican Republic government at a very low wage.

One carreau or just over three acres is the average size for a plot of land a Haitian farmer owns. The land is split up among the generations of the family. Some of the Haitian farmers do not even own the land but are tenants and share crop lands owned by wealthier Haitians or the government. Of all of the Haitians living on the island, 54% of them own goats because the goats are well adapted to the rugged terrain and sparse vegetation. Even more popular than the goats is the Creole pig which is cheap and easy to raise. Like the goats they are adapted to the terrain of the island. Also, 48% of all the farmers own at least one head of cattle which until 1985 were exported for the American Baby Food Industry. Most livestock raised by the Haitians serve as a type of savings account. The animals are sold or slaughtered to pay for education, marriage ceremonies, medical emergencies and seeds for crops.

In their 'garden' the Haitian farmer grows sugar cane, rice, hard bananas, plantains, and corn. Also there are watermelons, pumpkins, lima beans, papaya and some coconuts. Cotton is sometimes grown to stuff household bed mattresses. Most of the farmers understand crop rotation and that if sugar cane is grown they must plant rice and sweet potatoes three times before they can grow more sugar cane. The agricultural practices used by the Haitian Farmer are quite primitive. The plots farmed are tiny making it inappropriate to use farm machinery. Instead farmers use hoes, machetes, digging sticks and serpettes. Also the land is very dry since the rainy seasons do not occur during the growing seasons. Because of this, nearly 130 irrigation systems are used by nearly 80,000 users. However there is a charge to use these systems which the farmers sometimes cannot afford.

The men work in the fields relying on the women to not only get water for drinking, cook meals and take care of the children but to be street venders in markets. For most women this means a ten to fifteen mile trip on foot to sell their goods for little profit. The family will only sell goods if there is enough to support themselves.

Some major barriers to improving the agricultural productivity and farm income for the Haitian farmers circulates around four major things; land rights, the rainy seasons, access to credit and deforestation. Land rights are a major dispute among Haitian families. When a family member passes on, they split their land between their children making the plots smaller and smaller as generations continue. The land that is not owned by a farmer is costly to tenant and share crop. Next are the dates for the rainy season. These seasons do not occur during the same time that the growing seasons occur leaving the ground dry. This is where the irrigation systems play a large role in Haitian farming. Unfortunately they come at cost and the farmers cannot always afford the access to these. Also the Haitian peasants have little or no access to credit which would benefit them greatly. The credit unions are afraid that they will not receive the money that they lend out. Lastly, there is deforestation which is one of the most serious barriers the Haitians have. Only about 2% of the country has tree cover. The trees are being cut down to make room for farmland and used as an energy source. As a result nearly 15,000 hectares of cultivated land are lost to erosion every year. Because of the limited natural resources on the island, Haiti has begun to look into alternative ways to fuel the country.

In Haiti, the country's primary demand for energy is cooking fuel for houses. In rural households the families rely mainly on firewood rather than the charcoal that the urban lower class families use. The energy sources that Haiti buys costs several times the amount spent on the locally produced energy. With the deforestation due to energy demands, Haiti needs to turn to other means to produce energy for the Island. Before Haiti takes a larger dip in the pool of Biofuel opportunities, they need to cover a few issues pertaining to reversing the natural resource degradation of the forests and adapting the farming in the country to water scarcity and climate changes that occur.

Currently resource degradation plays an average role in causing a farm family to produce little food or earn sufficient income, but as the years go on it will prove to play more of an effect. When a farm cuts down the trees to use as an energy source, it makes more room for crops. Although degradation doesn't necessarily affect the amount of food or income the farmer makes, it is an extremely severe issue because of soil erosion. As mentioned only 1% of the country has tree cover and because of this soil erosion is taking a toll on the country. Nearly 15,000 acres of land is lost every year to erosion. Organizations are planting trees in attempt to reverse this effect but the trees are not growing fast enough to meet the countries demands. If the forest degradation continues Haiti faces the loss of not only an energy source but their forests all together. For the farm family this would have a large effect because the little land they have for farming now would diminish as the years pass. To improve this factor, to preserve the environment, Haiti needs to turn to an alternative source to the commonly used charcoal.

The role that adapting farming to water scarcity and climate change plays in causing a farm family to not produce enough food or earn sufficient income is large. The rainy season in Haiti occurs at a different time than the growing season for the farmers leaving the ground at that time dry and in need of an irrigation system. The many irrigation systems that run through the country come at cost for the farmers to connect to. Most of the time this cost is too much for the farmers afford so the ground becomes hard and dry making it difficult to grow crops. Unlike the forest degradation, the water scarcity does not have as much concern for getting worse. It stays the same every year only becoming worse if the farmer is unable to connect to the irrigation system. Improving this factor to increase the amount of food or income available to the farm family would greatly help them making it so the land is more suitable for growing crops.

Biofuel production could affect the status and trends of the mentioned factors by only improving the conditions. A certain type of plant called the Jatropha has been tested in the country with successful results. The Jatropha is a hardy plant that is drought and pest resistant and produces seeds that have 40% oil. It can survive on 250 mm of rain. The oil from the plant can be used as a cooking and heat source as well as turned into a biodesiel. Jatropha has been used in other countries such as India where there is a train between two cities that is run completely on the oils from the Jatropha plant. It can grow in wastelands and infertile grounds, fertilize the soil that it grows in, and produce as much as four times the amount of fuel as soybeans and ten times more fuel that corn. For Haiti the Jatropha plant would be an adequate substitute for fuel due to the reason the plant is naturally occurring on the island. In fact, the Jatropha plant originated in the Caribbean Islands and exported to other countries as a hedge by traders. In Haiti the plant is used as a natural fence to keep animals on a farmers land. Animals extremely dislike the taste of the plant so nothing will eat it. Jatropha also has been proven to have substantial anti-erosion factors that make it perfectly suited for Haiti. A recent study done by the USAID has reinforced the fact that planting Jatropha would be more effective than the tree planting efforts that have been attempted in the country. This fast growing plant can produce its seeds in three months and strives in Haiti where most crops have trouble with the infertile and dry grounds. In order to produce a biofuel from Jatropha, the seeds must be pressed and turned into oil. The presses that are available for this are now made to suit a small rural area and are inexpensive. The market for the oil is small but growing. The oils produced from the seeds can also make soaps and lotions that can be sold as profit which can only help the family farm.

Based on the above research the use of biofuels in Haiti should defiantly be implemented to help improve the situation for the family farm and the country. The use of charcoal would lessen and deforestation would start to slow down as well. In order to implement biofuels Haiti, would need to educate the farmers on the benefits of the Jatropha plant and introduce it more. Access to the credit should be given to the Haitian farmer so that they could invest in the seeds and a press. By making the Haitians accustomed to the benefits of the Jatropha it would open a larger market for the oil to be sold giving the farmer more of an income. Organizations can also get involved to help implement the ideas of using biofuels in Haiti by donating money to help support the farmers and teaching the Haitians and other

people the benefits of using the Jatropha plant. Some organizations have researched and should continue to research the different plants that can reverse the effects of deforestation and soil erosion. These organizations have helped turn a page in biofuel production.

Haiti is a country that uses charcoal as a main source of energy causing the forests in the area to be cut down. Due to this soil erosion is eliminating thousands of acres of land every year. The land that is left, being dry and infertile, is unsuitable for most crops. The rainy seasons that occur during the year happen at different time than the growing season leaving the farmers to turn to irrigation systems to water their land. But to connect to the irrigation systems, the farmers must pay. Most farmers cannot even afford to educate their children let alone tap into the systems. A different energy source is needed and the Jatropha plant may be that source. The plant has anti-erosion qualities and grows in almost any condition making it highly suitable for Haiti. Even though this seems like a perfect alternative to the charcoal, most Haitians are not yet aware of the qualities and the market for the oil is small. With knowledge the Haitians can create a larger market created and an eroding country might have a way to start reversing the natural resource degradation.

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