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Biofuels in Mali: Decreasing Food Insecurity

Introduction

Across the world, farmers in developing countries are suffering from food insecurity. Food insecurity occurs when families do not have the money or resources to supply enough food to fulfill the minimum energy requirements for their families. To become food secure, farmers need to experience increased yields. To increase yields, West Africa needs to fix problems with soil degradation, a diminishing crop market, and a lack of water among other things. To fix these problems, farmers need more money, education, and resources. To increase their profits, some farmers are supplementing their incomes by selling crops to produce biofuels.

Using biofuels rather than other fuels provides several benefits. In the United States, most people know that biofuels are used to reduce the carbon footprint of vehicles. Since carbon emissions contribute to global warming, environmentalists encourage consumers to use ethanol and biodiesel. Farmers who grow crops that are now used to create biofuels are benefiting greatly from this new trend. This new market adds value to their crops, so farmers are able to sell their crops for more money. Also, by producing fuel locally, the United States and other countries rely less on imported oil. Less reliance on foreign oil improves our economy.

Unfortunately, biofuel use also has disturbing drawbacks. Many Americans are under the assumption that ethanol is beneficial to the environment. However, the amount of energy used to create ethanol from corn is in many cases more than the energy it produces. Also, the amount of corn used to make enough ethanol to fill a 25 gallon fuel tank would be enough to feed one person for an entire year. To fulfill the world's fuel supply using biofuels, large forested areas would have to be cleared to make way for more fields. All these things are disadvantageous to poor farmers across the world.

To be beneficial to these poor farmers, biofuels must be implemented cautiously. Ideally, crops grown for biofuels would increase profits of farmers while not competing for resources. Farmers must also make sure that their production of food crops is not compromised in any way. Forests need to be protected from over-cultivation for biofuel production. If farmers are able to balance all aspects of production, biofuels could be an invaluable supplement to the incomes of the poverty-stricken in Mali and across the world.

Typical Subsistence Family Farm

The people most affected by poverty in Mali are subsistence farmers. According to the United Nations Human Development Index, Mali ranks as the 175th most developed country on the list of 177 countries. This number reflects problems in education, adult literacy, GDP, and life expectancy. Since 80% of the workforce works as farmers and fishermen, problems facing agriculture hurt a large portion of the country's population.

In Mali, the family unit usually consists of an extended family living together as a small community. Each smaller family lives in an individual hut surrounding a large central gathering area. The women use this area to cook meals of rice or millet with a flavored sauce. On special occasions,

vegetables may be added to the diet (“Ouelessebougou”). Poverty is so widespread that 90.6% of people living in Mali subsist on less than \$2 USD every day (“Rural Poverty”).

In the family, men usually farm the fields while the women care for the children, cook, and collect water. Children are also necessary to the running of the farm. So many children must help at their homes that only 35% attend primary, secondary, or tertiary schools (“Human Development”). Due to the commonality of harmful diseases, many family members are temporarily prevented from working. AIDS alone affects 1.9% of all Malian adults (“Mali” CIA).

The most common agricultural products grown by subsistence farmers in Mali are cotton, millet, sorghum, rice, corn, vegetables, and peanuts. Some farmers also raise cattle, sheep and goats (“Mali” CIA). To decrease soil degradation commonly caused by constant use of a single plot of land, farmers rotate cotton and cereal crops annually or bi-annually (“Scaling Soil”). Manure from cattle is the only available fertilizer to most poor farmers.

Farmers face many barriers when trying to earn a sufficient income. Mali has a total land area of 1.22 million sq km; of that, only 2,360 sq km is irrigated (“Mali” CIA). In rural areas especially, water is increasingly scarce. Only 36% of rural people have access to clean water. Nationwide, the number increases to only 50% (“Human Development”). Past and current droughts have caused water tables to lower, making existing wells less productive.

Factors Preventing Agricultural Sustenance

Water scarcity, climate change, and resource degradation play a huge role in preventing Malians from earning enough to feed their families. Drought causes the most immediate harm to this agrarian nation since reduced water availability leads to lower plant yields, more cattle deaths, and more disease transmission. Furthermore, when droughts reduce yields, fewer pastures are available for cattle grazing. Stocking rates of these rare pastures are further reduced when fire destroys dry plants. Malnourished cattle produce less milk and fewer offspring; at the same time, wild animals hunted by Malians who also use these pastures are dying off, all further reducing available food.

Climate change is causing many of the changes in water scarcity and resource degradation. The increasing of the average temperatures around the equator causes a severe change in weather patterns. Rain is less likely to fall in some parts of Mali. The amount of arable land across the country is decreasing as desert-like conditions reach past the Saharan desert into more parts of the country. Currently, two thirds of the country is considered part of the Saharan desert. Water scarcity and climate change together have caused enough of an impact that one group of nomads has been required to settle and rely solely on foreign aid.

Resource degradation in the way of deforestation is very common due to the need for cheap energy. In one region of Mali, wood provides an estimated 90% of household energy needs (Dembele). Since wood is a free resource, people are able to cut down any trees and then sell the wood for a profit. Vendors sell the wood for little money, causing sales of other fuel sources to decline since they can't compete with the low prices. Unfortunately, those people who are cutting down the trees do not understand the detrimental effects of their actions on the country. As forests disappear, plant and animal species die out. Also, sandstorms worsen when tree roots are no longer holding soil in place.

Currently, the environment is being severely degraded by excess use of the land, erratic rainfall, and deforestation. People in Mali are already forced to move to cities and other places where water is more readily available. For instance, so many people have moved to the town of Kidal, located just

outside the capital city of Bamako, that residents must wait in line at the few wells in the area just to get the water they need for the day. Fights caused by water shortages are common and dangerous (Cisse).

Malians do everything they can to take in as much food as they need. However, the previously discussed fundamental problems in farming prevent the poorest people from taking in the nutrients they need. In 1998, the FAO and WHO estimated that the average Malian requires a minimum of 1,810 kcal per day. However, they discovered that Malians are consuming an average of only 290 kcal per day per capita. This is only 16% of the minimum requirement ("Mali" United). Minimum calorie intake is determined by both weight and activity level. Undernourished farmers are less productive. This decrease in productivity leads to a decrease in plant yields, furthering the cycle of food instability.

The problems with water scarcity, climate change, and resource degradation are getting worse. Climate change is projected to continually worsen, so it would be nearly impossible to reverse the problems caused by increasing global temperatures. Scientists measure the trends in climate change and water scarcity by measuring plant productivity, water tables, and quality of grazing land. Some plants increase in productivity as carbon dioxide in the air increases, but others are not affected. All plants are harmed when water becomes scarcer. Water tables lower along with rainfall rates, causing wells that are not deep enough to dry up. The quality of grazing land is determined by stocking rates of the land. The number of animals that can be fed on a piece of land corresponds to the productivity of the animals fed by grazing. Due to these factors, the amount of farmable land is dwindling as more square km of land are added to the Sahara.

Solutions to Improving Food Security

Due to the many problems contributing to food insecurity in Mali, improving conditions will be no easy task. One possible, but completely improbable, solution would be to significantly reduce the production of greenhouse gases worldwide. This would prevent more people from being displaced due to lack of water and give poor farmers a chance to adapt to the change in the environment by adopting new farming practices. Along with this change, more water for irrigation, cooking, and drinking would need to become available. This would increase crop yields, increase crop residues that could be used as fodder, and increase personal health by reducing contact with water-borne diseases. Unfortunately, these changes would require huge investments from rich countries across the world.

Biofuels could potentially play a role in helping farmers earn enough money to become food secure, but there are also drawbacks to their use. Using staple crops like corn for ethanol production would only harm farmers. The increase in corn prices would allow farmers to sell their crop for more money, but any extra corn purchased would be more expensive. The crop residues that are currently used as fodder would become unavailable, which would lead to further decreases in animal productivity. If not carefully implemented, large farms operated by foreign interests could take over small family farms. The large farms would be more likely to be able to afford proper irrigation and labor. Luckily, there is a crop that can be used for biofuels without causing these problems.

The best plant Mali could use for biofuels would be jatropha. This plant is actually a weed used by farmers as a border around their crops. The appalling scent and inedible seeds keep animals away from the food crops inside. The seeds of the jatropha plant contain up to 37% oil ("Small-Scale Production). This oil can be easily refined into biodiesel, which can then be used to power generators. These generators can be used to provide all energy needs in a family. Currently, rural households have very little access to electricity. The quality of life for these people will be greatly improved with the introduction of an affordable energy source. Cook stoves are also available that use raw jatropha oil to cook food. Some villages in Mali have already adopted this practice, but most farmers don't yet know about the potential benefits of this plant.

Eventually, farmers could sell the seeds and fuel to supplement their income. Biodiesel produced from jatropha costs less per liter than traditional diesel, so producers of the fuel will have a large market. Western countries will be eager to purchase the biofuels, and the economy in Mali will improve. If too much of the fuel is exported to more developed countries, however, the benefits to local people are limited. To prevent excessive export, the government of Mali should implement restrictions on the selling of jatropha. It is important that the country meets its own energy needs before addressing the needs of other countries. These restrictions would also prevent farmers from moving away from staple food crops and growing only jatropha.

The implementations of jatropha as a biofuel should move slowly to allow time for farmers to adjust. Although these new farming practices have already been implemented in some small villages, other villages may have a harder time adapting to the new technology. Villagers could sell generators and cook stoves to increase money in the economy. When introducing technologies to villages and farmers, both men and women need to be encouraged to attend information sessions so that as many people as possible understand the benefits of biofuels. Unfortunately, the machines used to make the fuel are expensive, but this only further supports a slow transition so villages can adapt and not be left behind.

Jatropha would be the ideal supplement to small farmers' income since it requires very little care. The plants will grow without irrigation and with very little fertilizer. The process of extracting oil from the seeds for use as fuel produces a cake full of nutrients that is ideal for fertilizing the next year's jatropha and food crops (Polgreen). And since the lifespan of the jatropha bush is from 35-40 years, farmers would rarely need to put time or money into new bushes ("Small-Scale Production"). The most time-consuming part of growing jatropha would be harvesting the seeds. Traditionally, women harvest the seeds of the plant since they are the ones who use the seeds to make products such as soap. Women will likely continue with the harvesting.

Corporations and organizations could play the most vital role in increasing food security in Mali and in all of West Africa. Villages need help since they cannot afford the initial investment needed to purchase the generators and cook stoves required to make use of biofuel created from the jatropha seeds. Villages also need tools and instructions as to how to create the fuel. The initial investments are expensive, but the benefit to small farmers and villages is monumental.

Perhaps the most important thing corporations and organizations could do to improve conditions in Mali without hindering their independence would be to increase available water. Current wells are drying up, so they need to be extended and made more plentiful. By simply giving these people water, they are ensuring better health, greater productivity, and a right everyone deserves. After water becomes available, organizations could also install drip irrigation systems in small farmers' fields. Drip irrigation is the most productive type of irrigation because it delivers water directly to the roots of individual plants, decreasing waste and ensuring the right amount of water. This system would increase crop productivity and allow a larger variety of plants to grow in more places.

Conclusion

Mali is a very poor country, but with a little help from investors, it could begin to thrive. With careful implementation, biofuels could play a part in boosting incomes of small-scale farmers. Although their use may cause drawbacks, the potential for economic growth far outweighs the risk of harm. By using a plant that is already common and easily accessible to create biofuels, even the poorest farmers could implement changes that would help them earn a supplemental income.

This method of introducing biofuels to increase incomes would work not only in Mali, but also in other parts of the world. Many parts of West Africa are experiencing similar problems with climate change, water scarcity, and resource degradation, and, since jatropha grows in much of West Africa, other countries could benefit from its use as well. The low maintenance requirements for the plant make it ideal for growing in a variety of climates. It is true that biofuels may not be beneficial to all developing countries, but for those that have the proper resources, biofuels could prove to be a perfect solution.

Mali relies heavily on agricultural success, so as profits from farming increase, people will be able to invest more money into other things. An increase in money in the economy will lead to improvements in education, healthcare, and infrastructure among other things. More students will be able to attend school as more schools open in more areas. An increased school attendance rate will eventually lead to an increase in adult literacy. More money put into healthcare will increase children's survival rates and improve life expectancy. Increases in education, adult literacy, life expectancy, and GDP will cause an increase in Mali's score on the Human Development Index.

Most importantly, farmers need to be given the resources to help themselves. Villages need money to make the initial investments required to improve water availability and to purchase machines for creating fuel from jatropha seeds, but other than that, little foreign aid is necessary. This is an important aspect of the plan since simply handing out foreign aid does not improve the root causes of the problems. To be truly successful, the solution to the problems previously described must complement native cultures and traditions. Most farmers in Mali have been living in the area for generations, those people trying to improve it must respect their way of life. Although the current conditions are poor, Mali has the potential to become a very productive country.

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