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Biodiesel Production in Nicaragua

Introduction

Nicaragua is the second poorest country in the Western Hemisphere with unemployment officially at about 65%, 60% of whom work in the informal sector. It suffers from persistent trade and budget deficits (Background 5). In 2005, the total petroleum, fuel, and lubricant imports cost over 520 million dollars (Situacion 14). This cost equaled 22% of total imports and 61% of the country's exports. In other words, Nicaragua earned over \$857 million from exports in 2005, and most of that was used to buy petroleum. One cause is because 70% of the country's electricity is based on petroleum (Situacion 14). For Nicaragua to break its cycle of poverty, it will need to find alternatives to imported oil. Biofuels can play an important role in this alternative.

Nicaragua is now interested in reducing petroleum imports to make their own biodiesel and ethanol. There are many options for making biofuels in Nicaragua. They could make ethanol out corn or sugar cane. Biodiesel, on the other hand, could be made from soybeans, tempate (*Jatropha*), or oil palm.

Corn is the most important source of calories in the Nicaraguan diet (FAO). Nicaragua is not self-sufficient in corn production; therefore, it wouldn't make sense, from a food security standpoint, to use it to make ethanol. In addition, because of food security issues, Central American leaders recently gathered and agreed that corn will not be used for the production of ethanol.

Sugar cane is a better alternative for the production of ethanol. Although sugar makes up the third highest calorie intake in their diet, it is abundant and makes up about 40% of their agricultural exports (FAO). One of the problems with using sugar cane for ethanol is that it would take away from export income. Nicaragua is also limited in available land for sugar cane expansion because it can only be grown under certain conditions. The land that would be used to expand sugar cane plantations is land that is currently used for basic grains (rice, beans, corn, etc.). Therefore, Nicaragua could replace some petroleum with ethanol from sugar cane, but it would only be feasible for large farmers, not small producers who would not make any gains in food security or farm income.

Biodiesel has the greatest potential to reduce petroleum imports to Nicaragua. In the United States, the main source of biodiesel is from soybeans because it is so abundant. This is not the case with soybeans in Nicaragua. Although Nicaragua cultivates soybeans, like corn, Nicaragua needs all it produces for food and still has to import some. So, the same food security argument that applies to corn, applies here.

Tempate is another crop that has the potential to improve biodiesel production. Tempate is an extraordinary tree that grows in Nicaragua and is not used for anything at all, yet contains oil that can be used for biodiesel. This would be an excellent choice for biodiesel, but there are very few of these trees in Nicaragua at the moment, so they are trying to plant more and make this a possibility in ten to fifteen years. Also, tempate is currently an unproven technology, so it will take years to develop (Fernandez 1-2).

Oil palm is by far the best choice for Nicaragua to reduce or replace petroleum imports in the short term. Oil palm is the most productive oil seed in the world (Southern 2). Oil Palm produces 5-6 tons of oil per hectare per year, compared to soybeans and tempate, which produce only 2.7 and 2.0 tons, respectively. Nicaragua has more than 2 million hectares on the Atlantic coast that are apt for the

cultivation of oil palm. The Nicaraguan government estimates that to replace all of the diesel importations, only 167,000 hectares would be necessary. According to Instituto Interamericano de Cooperación para la Agricultura (IICA), the Nicaraguan government is now funding a study to determine the cost of developing 200,000 hectares of oil palm for complete replacement of imported diesel.

Huge challenges lie ahead if Nicaragua is to achieve energy self-sufficiency through palm oil. There will be problems over land ownership, how to prepare and maintain the land for growing palm oil, how to harvest the fruit, and how to market it. Adding to the difficulty is the lack of local technology providers that exist in Nicaragua. In the past, Nicaragua has tried to develop oil palm as a source of cooking oil, but failed due to various causes. This time around, the government has the advantage of learning from past mistakes, being part of a regional effort, and having access to technical expertise from other countries such as Brazil (Situación). As in the past, Nicaragua's success will depend on government leadership. Of the many hurdles that the country will face, the three major challenges that must be overcome to achieve this important goal are to provide effective financing, sufficient and capable technical assistance, and a comprehensive marketing infrastructure.

Financing

The highly underdeveloped Atlantic Coast of Nicaragua is the proposed site of oil palm production (Situación). Financing will be vital to getting small farmers involved in oil palm production. The government also wants private and foreign investors to get involved. This way the government won't have to fund the whole project by themselves. The amount of money the government can provide will play a huge role in how many small farmers can become involved, how long it will take to make the land productive, and how goods will be transported.

The government wants much of the oil palm to be produced by small farmers. I recommend that the government set up a model similar to one currently being used in Brazil. Under this model, the government would establish production units of 10,000 hectares for each 1,000 families (Situación). The number of 10,000-hectare production units will be determined by the amount of financing the government can provide. These 10,000-hectare units will be further broken down into 1,000-hectare plots. Each plot will be assigned to 100 families, which will be centrally located and will all work the same land together. From a financing stand point, I believe that this model will provide a higher probability for success because the structure allows resources to be pooled and generates more consistent production over larger areas. It also reduces the risk that individual families will not fulfill their loan commitments.

In this undeveloped region, the government will supply the land, equipment, fertilizers, and all other things needed to establish and run these farms. The government will also supply housing for the farmers. All of this will be provided in the form of a loan. In return, the farmers will sign a contract that agrees to work on this land for ten years, and yield a minimum amount of harvest. After ten years, if production requirements have been met and the loan has been paid off, each family will be granted a deed to ten hectares of land (Situación). On the Atlantic Coast, some indigenous groups are all ready accustomed to working as a community, so this model will fit them well.

Unlike basic grains, oil palm needs at least three years to mature before it can be harvested. Therefore, a big risk for government and farmers alike, they make a big initial investment and don't receive any pay back for several years. The initial cost per hectare, just for machines, equipment, land and planting preparation, and some farming infrastructure, such as roads, bridges, and drainage systems, will come out to almost \$1,300. During the next three years, crop management will cost about \$250 per hectare per year. This means that farmers will be investing three years and over \$2,000 per hectare in this tree before they receive any income from it (Saenz Mejia). That's \$20,000 before any crop is harvested, and they have given up income from other crops. So clearly, financing will be required to get these people

involved. Financing will be used not only to establish production units, but also for technical assistance and civil infrastructure.

Technical Assistance

Technical assistance is another key to Nicaragua's future success in oil palm. Lack of technical assistance is one of the main reasons why past efforts to establish oil palm plantations failed. Without proper knowledge of this new crop, farmers won't be able to perform agricultural practices necessary to protect and produce it. More than half of these farmers only have a sixth grade education (What); therefore, technical assistance will be especially crucial.

Unfortunately, this type of technical assistance does not yet exist in Nicaragua. There haven't been any successful oil palm plantations, so there isn't that much knowledge inside Nicaragua on how to manage a good plantation. If the recommended model is set up, where multiple families are working one big field, this problem could be solved. With the foreign aid that Nicaragua receives, they could bring in some experts from countries that are experienced in growing oil palm, to spread their knowledge. Because there will be large farms located next to one another, each farm can appoint a couple of people to train with these foreign instructors in order to learn the agricultural practices. They then can go back and share this information with the rest of their fellow farmers on their plantation. This is a much easier and faster way of spreading knowledge than having someone go from farm to farm, telling the one family, techniques on how to manage their crop.

After informing the farmers and government with the necessary procedures to best maintain the oil palm, the foreign experts are done. It is then the government's job, to spread this knowledge on to other sources so that the information doesn't get forgotten. The government mainly needs to inform technical service providers and the universities within the country. They need to inform technical service providers just in case someone else is either just beginning an oil palm plantation, or someone with experience just forgets how to do something. The universities need to be enlightened so they can give courses over these materials. If the universities teach this material, students will be experienced if they decide to create a plantation, and it won't take as long to set up and manage. As a result, not only will this information never be lost, but Nicaragua may become experts in growing oil palm and might have the opportunity to teach other countries as well.

Marketing Infrastructure

Marketing infrastructure is another major barrier that will be a challenge to palm oil production for replacing petroleum imports. Without roads to get to market and refineries, there is no way to sell your product. While transportation on the farm will probably consist of oxen-drawn carts, large trucks will be needed for taking the palm fruit to the refinery. This service will likely be performed by middlemen and may not require a large investment on the part of the government. Civil infrastructure, however, like roads, drainage canals, and bridges will.

Refineries can vary greatly in size. "Large-scale operations require rapid transportation of harvested bunches to the processing site, hence the need for investment in roads and civil works" (Agriculture). Depending upon the infrastructure and who finances the plant, there will likely be a mixture of large and small extraction facilities. Since there is only one oil palm refinery on the Atlantic coast of Nicaragua at this time, one thing is for sure, many more will be needed to service the 200,000 hectare area that is being proposed (Saenz Mejia). The government will most likely leave this job to private investors. There have been oil palm refineries in the past in Nicaragua, so there is experience on how to build and run them.

In the proposed model, refineries would be centrally located between the production units (Situacion). This way, fewer roads would have to be built, which means less money that the government

has to invest in civil infrastructure. An additional advantage to having centrally located refineries, is the amount of job openings for farmers and the extra income that this will provide. These jobs will include the construction of refineries and roads, drivers and mechanics for trucks, and working at the refinery, to name a few.

Finally, if the Nicaraguan government wants small farmers to invest in oil palm, they will need to provide them with price guarantees. As it is, the farmers will be giving up income for several years while the oil palm is maturing. After taking on this risk and finally obtaining their crop, they want to be assured that they will sell every one of them and for a reasonable price. One final advantage of the community model I have proposed, is it will provide more bargaining power to demand a fair price because producers are represented as a group rather than individuals.

Conclusion

In conclusion, if Nicaragua is determined to reduce poverty, it will be necessary to replace part or all of its imported petroleum. The Nicaraguan government is now evaluating the use of homegrown biofuels as a replacement. Most of the imported petroleum comes in the form of diesel, so targeting biodiesel makes the most sense. Out of all the possibilities, oil palm is the best option for making biodiesel. Although oil palm takes a few years to mature, it is well suited for Nicaragua's climate, and it generates the most oil per hectare of any crop. Among the challenges associated with creating this new industry are government financing, new knowledge concerning this crop, and newly built infrastructure. The government recognizes that this project provides a good opportunity for rural development and plans to integrate small farmers. I believe that the model proposed here helps overcome these obstacles.

In this model, communities of 1,000 families will farm 10,000-hectare plantations. There will be multiple plantations located near one another with strategically placed refineries between them. This type of compact and centrally concentrated production will minimize the civil infrastructure that needs to be financed, and will allow technical information to be shared more effectively.

This model also helps improve food security and farm income for small farmers. Due to the lack of opportunity on the Atlantic Coast of Nicaragua, successful implementation of this project would provide thousands of families with long-term stability and land rights. In addition to crop income, families will have opportunities to supplement farm income by constructing infrastructure and running refineries.

The government will need to play a tremendous role in this project if Nicaragua is to become self-sufficient in the production of biodiesel. They will need to conquer three major issues – financing, technical assistance, and marketing infrastructure. The establishment of palm oil in Nicaragua could change their economy drastically. They may no longer have to rely so heavily on importing petroleum to produce energy, and will have more money left to spend on national development and other necessities.

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