USDA Foreign Agricultural Service
GAIN Report
Global Agricultural Information Network

Required Report - public distribution

Date: 7/3/2012
GAIN Report Number:

Honduras

Biofuels Annual

2012

Approved By:
Henry Schmick, Agricultural Counselor
Prepared By:
Ana Gomez, Agricultural Specialist

Report Highlights:
Honduras is the only Central America country that has a law and a regulation for both biodiesel and ethanol production. The regulation provides a mechanism to define the ratio (mix) of biofuel with diesel or gasoline. Honduras' increase in the production of African palm oil provides opportunities for biodiesel. Additionally, new initiatives have been established such as the production of biofuel from tilapia by-products and Jatropha, the production of biogas sold for carbon credits, and the production of biomass to burn for electricity. However, there is no commercial production of biofuels due to market constraints.

Executive Summary:

Honduras' growing demand for fuel provides an excellent opportunity to develop biofuels. Honduras is currently highly dependent on imported oil and gas for meeting a significant proportion of its energy needs. In 2010, imports of diesel were 5.1 million barrels, and in 2011, 5.2 million. The import value was US$484 million in 2010 and US$680 million in 2011. The import value increased 40 percent from 2010 to 2011.

To meet fuel demands, increase employment and incomes in rural areas, reduce carbon dioxide (CO2) emissions and foreign exchange, Honduras has the legal framework through the "Law for the Production and Consumption of Biofuels" and the installed capacity to produce biofuels. The country provides excellent conditions for African palm oil production. In 2011, African palm oil production reached 390,000 metric tons of oil from a cultivated area of 135,000 hectares (ha). In 2005, the Honduran Ministry of Agriculture and Livestock (SAG) identified 200,000 ha. of land suitable for potential expansion of African palm.

Honduras has eleven African palm oil extracting plants. Five of those plants have the equipment and appropriate facilities to produce biofuel. The five plants together have the installed capacity to produce 66,100 gallons of biofuel per day. During previous years, they produced biofuel mostly for their own consumption. However, the plants are currently not producing biofuel. The cost of biofuel production in Honduras is affected by a higher international price obtained with the sale of African palm oil. The main obstacle for the industry is deciding what is more profitable: to sell the oil for food and other types of processing, or to make biofuel.

Honduras has various innovative biofuel projects being currently developed in Honduras. One relates to biofuel obtained from the processing of tilapia, and the others involve using by-products of African palm oil for the production of biogas and biomass for electricity generation as a substitute for fossil fuels. However, biofuels are currently only produced for small-applications within specific projects, and there is no commercial production.

Policy and Programs:

The GOH's legal framework is well suited for the development of biofuels. Honduras is the only Central American country that has approved a law and a regulation that treats biodiesel and ethanol production equally. The law provides exemptions from customs tariffs, income tax, and other related taxes for 12 years. These incentives are available for businesses using at least 51 percent of the feedstock of Honduran origin.

The GOH created "The Law for the Production and Consumption of Biofuels" in November 2007. Three GOH Ministries worked on the design and implementation of policies for the production of biofuels and their promotion in the market. The participating Ministries are: the Ministry of Industry and Trade (SIC), the Ministry of Agriculture and Livestock (SAG), and the Ministry of Natural Resources (SERNA). According to the Law, SIC is responsible for the promotion, commercialization, distribution, and storage of biofuel. To accomplish these tasks, SIC created the Technical Unit of Biofuel (UTB). The UTB is made up of representatives from SAG, SERNA, and the Honduran

Council of Private Enterprise (COHEP).

The Biofuels Law provides a legal basis for assigning funds to promote production and provide incentives for the transformation of feedstock into biofuel. These funds can be used for the purchase of equipment, materials, and services used for the planting, design, installation, construction, and operation of projects.

The regulation provides a mechanism to define the mix of biofuel with diesel, and of ethanol with gasoline. A decree is pending to be approved by Congress to have some reforms to the regulation. The reform proposes as an obligation to have a mix of five percent of ethanol with gasoline. The mix percentage will be gradually increasing to 10, 15 and 20 percent up to year 2020. The ethanol will be produced from Honduran sugar cane. The regulation will enter into effect as soon as it is approved.

Another reform will be that the GOH electric company ENEE will pay 4.6 cents of Lempira (L.19.64 equals US$1) per kilowatt of electricity produced from forest biomass. This is an incentive to increase forests biomass commercial value. As 44 percent of Honduras is forest land, a well managed forest can produce up to 10 cubic meters of biomass. Currently 1.4 cubic meters of biomass is being produced.

The GOH believes that biofuel will bring an increase in employment and incomes in the rural areas. For example, it is calculated that one hectare of African palm can produce 1,000 gallons of African palm oil. Each hectare can create 1 direct job and 2 indirect jobs. If 1,000 hectares are planted and two percent biofuel is added to diesel, 1,000 direct jobs and 2,000 indirect jobs could be created.

A GOH initiative to develop the African palm sector was a loan that SAG requested to the Central American Bank of Economic Integration (CABEI) for US$7 million. During the first stage of the loan, 700,000 Malaysian palm seeds were imported and planted on 4,238 ha. The second stage of the loan supported the importation of 900,000 seeds of high quality genetic material for planting 5,195 ha. The seedlings are already in nurseries to be planted in late 2012. The GOH is also providing loans to the African palm producers through the National Bank for Agricultural Development (BANADESA). The loan is given in the form of plants from nurseries and fertilizer for two years.

The private sector, non-governmental organizations (NGOs), and international organizations have developed innovative programs for making biofuel from African palm, jatropha (Jatropha curcas), and higuerillo (Ricinus communis). Additionally, new initiatives in the production of biofuels have been established such as the production of biofuel from tilapia by-products, the production of biogas sold for carbon credits, and the production of biomass to burn for electricity.

The GOH through SAG will hold the IV Latin American Conference of Round Table on Sustainable Palm Oil (RSPO) in 2013. The RSPO is a certification in which producers and buyers of palm oil agree to have it as an obligatory standard to be applied by 2015. The RSPO certifies that the palm oil is produce from the farm to the palm oil extracting plant in compliance with all the social, labor and environmental regulations. It will strengthen producers groups to work under the same procedures.

The Government of the United States and the Government of Brazil signed a Memorandum of Understanding (MOU) to Advance Cooperation on Biofuels in 2007. Both countries will work jointly

through feasibility studies and technical assistance aimed at stimulating private sector investment in biofuels. The MOU intends to bring the benefits of biofuels to Central America and the Caribbean to encourage local production and consumption of biofuels.

The programs that have supported biofuels follow:

- The German Development Service (DED) conducted a six-month experiment with biofuel in 2007. The experiment featured six public transportation buses powered by biofuel made from African palm oil. The GIZ- German International Cooperation is providing currently training to owners and employees of mechanical workshops to install and maintain equipment so they can use Jatropha biofuel. The equipment costs US$450 and is made in Honduras.

- The Colombian government donated a biofuel plant to SAG in 2009. SAG made an agreement to have the African palm producers association manage the plant. The plant has a 24 hours production capacity of 20,000 liters. The plant is still not working due to equipment modifications and because it is not profitable to produce biofuel.

- TechnoServe - an U.S. private-voluntary organization (PVO) implemented with the Honduran PVO Foundation for the Rural Agribusiness Development (FUNDER) the "Green Drop" project to increase its coverage and strengthen biofuel production. TechnoServe provided this assistance with USDA funds from 2009-2011. The project founded *Biocombustibles de Yoro* (BYSA), a company created to commercialize the biofuel products and basic food crops.

- TechnoServe provided BYSA with technical, business development assistance and helped individual producers to set up farms that combined Jatropha with short cycle production crops. BYSA has about 300 small producers as business partners. Currently, the biofuel processing plant utilizes used oil as feedstock to produce biofuel. The biofuel is sold in the city of Yoro for trucks, buses and agricultural machinery. Biofuel production in 2011 amounted to 3,675 liters.

- The Honduran Foundation of Agricultural Research (FHIA) provided support to the "Green Drop" project in the research component of the project.

- The "Green Drop" project was created initially by the Social Trade Organization (STRO) and HIVOS from Holland with FUNDER. The project also received assistance from the European Union, DOEN Foundation, FACT (Holland), Dajolka (Denmark) and AGERATEC (Sweden). Currently, CORDAID from Holland is providing assistance to BYSA.

- USDA is supporting a demonstration project led by the Honduran National Coffee Institute (IHCAFE) to produce energy using residual biomass from the coffee production process.

- The University of Massachusetts will use Jatropha oil from BYSA to produce electricity for a coffee-producers cooperative.

- The Central American Technological University (UNITEC) in Honduras has created a degree in Specialist in Renewable Energy, in which 240 hours are devoted to renewable energy, energy

efficiency, biofuels and use of biomass.

- The Pan American School of Agriculture – Zamorano has a five-year project (2009-2013) funded by the Syngenta Foundation for Sustainable Agriculture. The project has the following components: agronomic trials, plantation of 13 ha. of Jatropha, creation of a germplasm bank, evaluation of the oil and diesel quality, oil extraction and biofuel production, distribution and local uses and the project's integration into the global Jatropha research network. Zamorano will convert Jatropha seeds to biofuel in its pilot biofuel plant by the end of 2012. Research tests will take place such as: the quality and storage stability of Jatropha-based biofuel.

- In 2010, Agroenergia de Honduras S.A. (AGROENHSA) started to grow Jatropha for lubricants and biopesticides. Currently, they have about 600 ha. planted with Jatropha. They plan to have 5,000 ha. by 2015. They are performing tests to develop biofuels for aircraft use when there is enough commercial production. Further information can be found at: www.agroensa.com.

Bioethanol and Biodiesel:

Ethanol Production

Currently there is no commercial ethanol production in Honduras. The Honduran Sugar Producers Association (APAH) advocated for the design and approval of the Biofuels Law. APAH saw this law as key for investment in ethanol production. Through their investment plans, APAH has planned a feasibility study of the infrastructure and funding requirements to build an ethanol processing plant. The cost of an annex distillery with a daily capacity of 300-400,000 liters would be about US$ 50 million if the plant were installed in an existing sugar mill. If a new sugar mill with an ethanol processing plant were built, the cost would be about US$170 million. Currently, sugar and molasses have a high price in the international market. This is more economically feasible, than to invest in an ethanol plant. In addition, they need the GOH's assistance to protect investments and provide clear and solid biofuel policies to be implemented in a long term.

The sugar mills produce the energy they use during the harvest months through the use of bagasse (the biomass remaining after sugarcane stalks are crushed to extract their juice). The mills can generate 128 Mw-h, with an installed capacity of 344 Mw-h of electricity. They sell about 55 percent of the electricity to the GOH's electric company ENEE. Due to the high price of oil, one of the mills is using coal to produce energy for the ENEE during the non-harvest season of May-November.

Ethanol Consumption

Currently there is no commercial ethanol consumption in Honduras.

Trade

Under the Central American-Dominican Republic Free Trade Agreement (CAFTA-DR) with the United States, there are opportunities for ethanol production. The participating countries have duty-

free access to export to the United States the ethanol produced from regional feedstock. CAFTA-DR quotas are equal to seven percent of U.S. ethanol consumption. If consumption increases in the United States, the quota can also increase.

Biofuel Production

Honduras provides favorable geographic and climatic conditions for the production of biofuel. The African palm plant is the primary source to produce biofuel in Honduras. In its 2006 "Register of Characterization and Geo-Referencing of the Members the African Palm Agri-Food Chain," the Ministry of Agriculture and Livestock (SAG) observed that African palm production can expand to 200,000 ha. In 2011, there are 135,000 ha. under cultivation. The main obstacle for the industry is deciding what is more profitable: to sell the oil for food and other types of processing, or to make biofuel.

a) **Biofuel from African Palm**

African palm production in Honduras began commercially in 1971. As part of the agrarian reform, producers organized into agro-industrial enterprises. One of their objectives was to expand the production of African palm in the regions of Cortés, Atlántida, Yoro, and Colón, all on the north Atlantic coast. In 2006, the GOH implemented an investment plan for African palm which established the Register of Characterization and Geo-Referencing. This Register included the elaboration of the location of the African palm sector. It has an interactive database that links together socioeconomic factors, production, and the location of the plants (extracting, fractioning, and refining). Honduras has approximately 7,500 units that produce African palm, which is equivalent to more than 18,000 independent producers.

The national average yield of African palm fruit was 15.5 MT/ha/year in 2007. In 2011, the fruit yield increased to 17 MT/ha/year. The increase is due to technical assistance and training, improved genetic material, and better management of the plantations by the producers. The yield is affected by the diversity of micro-climates, soil types, and genetic varieties of the African palms, pests, irrigation and the availability of credit to buy fertilizer. Yield in the processing stage is affected by the quality of fruit. Fruit which is harvested green will likely be damaged during transportation. Additionally, the state of the plant and the equipment influences the yield.

Another factor in African palm management is that the average age of the plantations is about 14 years meaning that significant replanting is needed. This will provide employment which the GOH is highly interested in increasing. Immigration of young people from the African palm areas is decreasing. This is due to the support given to small producers to become entrepreneurs, which allows them to hire more members of their families.

Since 2000, demand for African palm oil has been growing. Of the 390,000 MT of African palm oil produced, 206,000 MT of palm oil were exported in 2011. 60-70 percent was exported to El Salvador

and Nicaragua and 30-40 percent was exported to Mexico. Exports of African palm oil in 2011 amounted US$250 million.

There are eleven palm oil extraction plants that are owned by six export companies. The five plants listed below have the equipment to produce biofuel. During previous years, they produced biofuel mostly for their own consumption for their company's vehicles, machinery and irrigation pumps. However, the plants are not currently producing biofuel. This is due to the higher cost to produce biofuel compared to the cost of fossil fuel. Fossil fuel is subsidized by the GOH, which has an effect on its real price. In addition, the cost of biofuel production in Honduras is affected by a higher international price obtained for the sale of African palm oil. The chart below shows the installed capacity of these plants. The plants could produce biofuel at 10 percent of their processing capacity.

	Oil Extraction Plants	**Installed capacity to produce biofuel (Gallons/per day)**
1	Dinant	36,000
2	Jaremar	25,000
3	Salama	2,800
4	Hondupalma	1,500
5	Coapalma	800
	T O T A L	66,100

Source: PRONAGRO, Ministry of Agriculture and Livestock

Dinant Corporation is one of the leaders in African palm oil production. The corporation manages 17,000 ha. of land. Fifty percent of its oil production is exported. The average annual capacity to produce African Palm oil is 345 million gallons. Dinant uses the remaining oil to produce processed oil products.

In 2006, the Dinant Corporation began operation of a biofuel processing plant. It used biofuels (B100) to fuel its distribution trucks and six public transportation buses in Tegucigalpa. The only modification it made to its vehicles was to change the filters. The processing plant can be enlarged for a capacity of 36,000 gallons of biofuel (B100) per day, enough to run a fleet of diesel trucks, tractors, equipment for irrigation, other vehicles, retro-excavators, and a bulldozer. In August 2008, the price of fossil fuel decreased and it was not profitable to continue producing biofuel.

b) **Biofuel from Jatropha Curcas**

The land and climate in Honduras are highly suitable for the growth and production of Jatropha. This tree-like plant grows in marginal soils and has a limited requirement for water. The plant bears fruit twice a year for 25 productive years, but needs extensive labor. During the first year, the plant may provide 10 percent of its potential oil yield and the percentage continues to increase until it is mature.

At maturity (4-5 years), Jatropha can provide 1,500 – 2,000 liters of oil per hectare. Since Jatropha grows on poor quality soils, it does not compete with land for food production. In addition, the quality of the biofuel from Jatropha is comparable with corn or soybean oil. Its quality is better because it does not require further refining, which results in less processing.

The programs that support Jathropa's biofuels technology development and commercialization of production in Honduras were listed in the Policy and Programs section above mentioned.

Investment is needed for the producers to grow Jatropha. Honduras has the know-how, but, producers need financing to manage a plantation and earn a living during the three years it takes the plants to reach maturity. There are about 1,000 ha. of Jatropha planted in Honduras in various stages of growth.

c) Biofuel from Fish Processing

Aquafinca Saint Peter Fisheries is the largest tilapia farm in Honduras, producing 32,850 MT of fresh fish every year. In 2006, Aquafinca opened a biofuel plant which uses tilapia waste. The fish remnants (guts, heads, skins, and internal organs) are rendered into oil which is processed into biofuel as a fuel stock. Approximately 40 percent of these fish remnants (48,000 pounds per day) are used to produce biofuel every day. In 2011, Aquafinca produced 1.0 million liters of biofuel and used it to run the company's vehicles. This biofuel replaced about 60,000 gallons per month of fossil fuel. Aquafinca was awarded the Latin American Award of the Environment in 2006. In 2010, Aquafinca received the U.S. Ambassador in Honduras's Renewable Energy Award. Further information can be found at: http://aquaticbiofuel.files.wordpress.com/2009/08/fishwaste-biodiesel.pdf

Biofuel Consumption

Currently, there is no commercial biofuel consumption in Honduras. The one tilapia by-product processing plant mentioned above utilizes the biofuel for its own consumption. The biofuel powers generators, irrigation equipment and company vehicles.

Stocks

Currently there are no commercial stocks of biofuels in Honduras.

Biomass for Heat and Power:

The biogas and biomass programs and projects currently carried on are the following:

EECOPALSA, a private Honduran company, uses the waste water from its African palm oil extracting plant (PALCASA) to produce clean energy. The waste water obtained from washing down the oil extraction equipment is stored in three covered lagoons where it decomposes and creates biogas. The

composition of biogas is 57-60 percent Methane (CH4) and 35 percent Carbon Dioxide (CO2). The biogas is captured and burned in engines to create 1.266 kilowats per hour (Kw/h) of electricity in the first phase. The second phase burns 900 Kw/h. The total amount of energy produced with biogas is 2,166 Kw/h. EECOPALSA is developing plans for a third phase that will create additional 1,000 Kw/h at the end of 2012. The biogas saves about 46,000 MT of carbon emissions annually, and through its registration with the Clean Development Mechanism (CDM) of the United Nations (UN) Framework Convention on Climate Change (UNFCCC), EECOPALSA sells carbon offset credits to Government of Switzerland.

EECOPLASA is the first African palm biogas project in the world certified for carbon credits with a category of Gold Standard. In 2011, EECOPALSA received the European International Trophy to Quality – New Millennium Award. In addition, the same year, EECOPALSA received the U.S. Ambassador in Honduras's Renewable Energy Award. Further information can be found at: http://www.onecarbon.com/ and http://cdm.unfccc.int/UserManagement/

EECOPLASA has also developed the technology of boiling the solid waste (biomass) of the African palm to produce electricity. About three MT of African palm fruit produce one MT of biomass. Approximately 9.6 MT of biomass can produce 3.4 mega watts (MW) of electricity per hour. The biomass creates 3,400 Kw/h of electricity and saves about 14,000 MT of carbon emissions per year. EECOPALSA sells carbon offset credits to the Government of Belgium.

Grupo JAREMAR, an industrial and commercial cluster in Honduras operates a biogas plant generating electricity from the capture of methane released in the production of African palm oil. The biogas is captured and burned to create 848 Kw/h of electricity and 8.5 MW in thermal energy (as vapor). The thermal energy produced offsets the equivalent of 650,000 gallons of fuel oil annually and more than 40,000 MT of carbon dioxide. The company also runs a biomass plant that creates 1,600 Kw/h of electricity. This saves 40 percent of the electrical energy purchased from the national (government-owned) network. Grupo JAREMAR also works with the Kyoto Protocol and UNFCCC's Clean Development Mechanism.

Notes on Statistical Data**:**

Conventional & Advanced Bioethanol (million liters)							
CY	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Production	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Imports	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Exports	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ending Stocks	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Production Capacity (Conventional Fuel)							

No. of Biorefineries	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Capacity	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Production Capacity (Advanced Fuel)							
No. of Biorefineries	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Capacity	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Co-product Production (1,000 MT)							
Product Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Product Z	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Feedstock Use (1,000 MT)							
Feedstock A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Feedstock B	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Feedstock C	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Feedstock D	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Conventional & Advanced Biodiesel (million liters)							
CY	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Production	1.0	1.1	1.0	1.0	0.9	0.9	0.9
Imports	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Exports	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Consumption	0.9	0.9	0.7	0.9	0.6	0.6	0.6
Ending Stocks	0.09	0.18	0.36	0.14	0.3	0.3	0.3
Production Capacity (Conventional Fuel)							
No. of Biorefineries	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Capacity	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Production Capacity (Advanced Fuel)							
No. of Biorefineries	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Capacity	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Feedstock Use (1,000 MT)							
Tilapia remnants	6.2	6.5	6.2	6.0	5.4	5.4	5.4
Feedstock B							
Feedstock C							
Feedstock D							

Source: Aquafinca

Biogas (KW/hour)							
CY	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Landfill	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sewage Sludge							

	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Field Crops/Manure	2,114	2,114	2,114	2,114	3,014	3,014	4,014
Total	2,114	2,114	2,114	2,114	3,014	3,014	4,014

Source: EECOPALSA and JAREMAR

Biomass (KW/hour)							
CY	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Landfill	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sewage Sludge	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Field Crops/Manure	1,700	1,700	2,200	5,000	5,000	5,000	5,000
Total	1,700	1,700	2,200	5,000	5,000	5,000	5,000

Source: EECOPALSA and JAREMAR