

USDA Foreign Agricultural Service

# GAIN Report

Global Agricultural Information Network

Required Report - public distribution

**Date:** 6/1/2009

**GAIN Report Number:** HO9006

## Honduras

### BIOFUELS ANNUAL

**2009**

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**Report Highlights:**

Honduras is the only Central America country that has approved laws and regulations for both biodiesel and ethanol production. The law provides exemptions from customs tariffs, income tax, and other related taxes for 12 years. The regulation provides a mechanism to define the mix of biodiesel with diesel, and of ethanol with gasoline. Honduras' increase in the production of African palm oil provides opportunities for biofuel development. The production of African palm oil has become more efficient leading to increased output and more land planted to African palm trees.

Additionally, new initiatives in the production of biofuels have been established such as the production of biodiesel from tilapia by-products and jatropha, the production of biogas sold for carbon credits, and the production of biomass to burn for electricity. Honduras has a Center for Scientific Support for the Production of Renewable Energy at Zamorano University.

**Post:**

Tegucigalpa

**Commodities:**

select

## **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 2006, imports of diesel were 4.6 million barrels, in 2007 4.9 million and in 2008, 5.1 million. The quantities imported of diesel had a slight difference between the years. However, the import value was US\$375 million in 2006, US\$440 million in 2007 and US\$629 million in 2008. The import value increased 17 percent from 2006 to 2007 and 43 percent from 2007 to 2008.

To meet fuel demands, increase employment and incomes in rural areas, reduce carbon dioxide (CO<sub>2</sub>) emissions and foreign exchange, Honduras is developing biofuels. The country provides excellent conditions for the production of African palm oil production, and in the last eight years such production has increased by 170 percent. In 2005, the Honduran Ministry of Agriculture and Livestock identified an additional 351,000 hectares of land suitable for potential expansion of African palm. In 2008, African palm oil production reached 380,000 metric tons of oil and land given to the cultivation of African palm accounted for 115,000 hectares.

Currently, Honduras has ten African palm oil extracting plants. Five of those plants, produce biodiesel at 10 percent of their capacity, and the biodiesel is used mostly for local consumption. These five plants have the capacity to produce 66,100 gallons of biodiesel per day.

The Honduran Government's (GOH) legal framework is also 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. The regulation provides a mechanism to define the mix of biodiesel with diesel, and of ethanol with gasoline.

The private sector, non-governmental organizations (NGOs), and international organizations have developed innovative approaches for making biodiesel from African palm oil and *Jatropha curcas*. Additionally, new initiatives in the production of biofuels have been established such as the production of biodiesel from tilapia by-products, the production of biogas sold for carbon credits, and the production of biomass to burn for electricity. To support biofuel development, Honduras has the Pan American School of Agriculture (Zamorano). Zamorano has a "Center for Scientific Support for the Production of Renewable Energy." Honduras also has four international airports, three of them located in the north of the country where the African palm is grown and exported. The cost of biodiesel production in Honduras is affected by the price of African palm oil and fuel. As the GOH takes away some of its fuel subsidies, consumer prices will rise. Subsequently, the incentive to use and produce biodiesel will increase.

## **Production**

Honduras provides favorable geographic and climatic conditions for the production of biodiesel. The African palm plant is currently the primary source of biodiesel 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 an additional 351,000 hectares (ha). Currently 115,000 ha are under cultivation. Another plant which is capable of producing biodiesel is *Jatropha curcus*. Honduras has 1,500 ha planted to *jatropha* and many national and international organizations are attempting to increase its production.

Honduras is using many innovative approaches to obtain biodiesel as described in the Marketing/International Cooperation Section.

The chart below shows products used to produce biofuels.

<b>Quantity of Feedstock Use in Biofuel Production in Honduras (Metric Tons)</b>						
		2004	2005	2006	2007	2008
<b>Biodiesel</b>						
Vegetable Oil						
	Palm oil	30,000	33,330	41,325	45,000	57,000
	Fish oil	0	68	405	912	1,216
	Jatropha oil	0	0	0	0	0
	Other (biogas)	0	0	83,000	95,450	109,767
<b>Ethanol</b>						
	Sugarcane	0	0	0	0	0

### **Biodiesel Production**

#### **a) Biodiesel 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 at the north Atlantic coast. In 2005, 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).

The Register (an extract of which is below) indicates the size and hectares owned in the African palm sector in 2005. An update of the total area planted in 2008 shows the 40 percent increase in area planted.

#### **Scale of African Palm Production**

<b>Description</b>	<b>Area (ha)</b>	<b>Total Area Planted 2005 (ha)</b>	<b>Total Area Planted 2008 (ha)</b>
Small	< = 10	6,799	17,699
Medium	10.01 - 100	14,386	36,386
Large	100.01 - 1,000	24,820	24,820

Large companies	> 1,000	36,095	36,095
Total		82,100	115,000

Source: National Agrifood Program (PRONAGRO), Ministry of Agriculture and Livestock

The national average yield of African palm fruit was 17.11 metric tons (MT)/ha/year in 2007. In 2008, the fruit yield increased to 18 MT/ha/year. The increase is due to technical assistance and training received, improved genetic material and better management of the plantations by the producers. Yield is affected by the diversity of micro-climates, soil types, genetic varieties of the African palms, pests, and the availability of credit to buy fertilizer. Irrigation is another factor that influences yield. The average cost to install irrigation is US\$640 per hectare making it too expensive for small producers. Most producers use pesticides to control weeds.

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. Labor is also becoming scarce since young people move away from the rural areas to take jobs at higher salaries in the cities.

Since 2000, demand for African palm oil has been growing. The chart below shows that over an eight-year period, production increased by 170 percent to 1.8 million MT. The chart also shows that planted area increased from 62,000 ha. to 115,000 ha., up 85 percent. Oil production increased 172 percent and exports increased 650 percent.

#### African Palm and Oil Production

Year	Hectares	Production Fresh Fruit (MT)	Production Oil (MT)	Oil Exports (MT)
2000	62,000	665,000	139,650	32,939
2001	65,000	735,000	154,350	36,000
2002	68,000	813,000	162,600	50,000
2003	73,000	900,000	180,000	54,000
2004	78,000	1,000,000	200,000	80,000
2005	82,100	1,111,000	222,200	120,000
2006	89,200	1,311,500	275,500	170,000
2007	100,000	1,400,000	300,000	200,000
2008	115,000	1,800,000	380,000	250,000

Source: PRONAGRO, Ministry of Agriculture and Livestock

Of the 380,000 MT of African palm oil produced, 85 percent is used to produce oil and 15 percent is used for biodiesel production. Of the 250,000 MT of palm oil exported, 60-70 percent is exported to Mexico and 20-30 percent is exported to El Salvador. Any residual amount is exported to Nicaragua and Guatemala. Mexico is eager to buy three times its current imports.

The Central American Bank of Economic Integration (BCIE) provided a loan to the Ministry of Agriculture and

Livestock (SAG) of Honduras. The loan was to import from Malaysia one million Malaysian palm seeds, of which 4,500 hectares have already been planted with 300,000 seeds. The remaining seeds will eventually cover 23,500 hectares. These seeds have greater yield potential and shorter maturation than the African palm seeds. Large nurseries have been built to support this planting program.

There are ten oil extraction plants that are owned by four export companies. The plants listed below have the ability to extract, refine, fraction, and make processed oil products (margarine, lard, cooking oil, and snacks). These plants produce biodiesel for their company’s vehicles, machinery and irrigation pumps. On an average, it takes 4.76 MT of fresh fruit to produce one MT of oil (at an extraction rate of 21 percent). The processing capacity of these plants is 66,100 gallons of biodiesel per day. These plants are currently producing at 10 percent of their processing capacity.

#### OIL EXTRACTION PLANTS IN HONDURAS

	<b>Oil Extraction Plants</b>	<b>Installed capacity to produce biodiesel (Gallons/per day)</b>
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 production. The corporation manages 19,000 ha of land. It also contracts with independent producers to plant and manage an additional 4,000 ha. Fifty percent of its oil production is exported. Dinant uses the remaining oil to produce processed oil products.

In 2005 the Dinant Corporation began operation of a biodiesel processing plant. It used biodiesel (B100 – a classification of biodiesel) 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 was then enlarged for a capacity of 36,000 gallons of biodiesel (B100) per day, enough to run a fleet of diesel trucks, tractors, equipment for irrigation, other vehicles, retro-excavators, and a bulldozer.

#### **b) Biodiesel from Jatropha Curcas**

The land and climate in Honduras are highly suitable for the growth and production of jatropha curcas. This tree-like plant grows in marginal soils and has 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 biodiesel 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.

In 2008, the farm AGROIPSA planted 1,000 hectares of jatropha. It is the largest commercial plantation in Central America. The seed is harvested, processed and exported to the U.S., Europe and South America. AGROIPSA will produce about 200,000 liters of biodiesel from jatropha in 2009. The biodiesel will be sold locally to generate electricity and to a public transportation company. In 2011, they plan to produce 2 million liters of biodiesel.

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.

**c) Biofuel from By-Products**

There are three innovative biofuel projects being developed in Honduras. One relates to biodiesel obtained from the processing of tilapia, and the others involve using by-products of African palm oil for the production of biogas and biomass.

**By-Product from Fish Processing (biodiesel)**

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 biodiesel plant which uses tilapia waste. The fish remnants (guts, heads, skins, and internal organs) are rendered into oil which is processed into biodiesel as a fuel stock. Approximately 40% of these fish remnants (48,000 pounds per day) are used to produce biodiesel every day. Aquafinca produces more than 360,000 gallons (1.4 million liters) of biodiesel annually and uses it to run the company’s vehicles. This biodiesel replaces 60,000 gallons per month of petroleum fuel. Aquafinca was awarded the Latin American Award of the Environment in 2006. The table in page 7 shows Aquafinca’s production and consumption of biodiesel.

**By-Product of Palm Oil Extraction (biogas)**

EECOPLASA, a private Honduran company, uses the liquid waste from its African palm oil extracting plant (PALCASA) to produce energy. The liquid waste obtained from washing down the oil extraction equipment is stored in a covered lagoon where it decomposes and creates biogas. The composition of biogas is 65 percent methane and 30 percent carbon dioxide (CO2). The biogas is captured and burned to create 1.266 mega watts per hour (Mw-h) of electricity. The biogas is sold for US\$21.00 per metric ton as carbon credit certificates every year at to the Swiss government.

EECOPLASA is the first African palm biogas project in the world certified for carbon credits. The following table shows the amount of fresh fruit utilized as feedstock for the production of biogas. The data also shows the energy (KW) biogas and carbon credits produced per year. Other Honduran companies are also starting to produce biogas from African Palm bagasse.

**BIOGAS PRODUCTION**  
(per year)

<b>Year</b>	<b>Fresh fruit Metric tons</b>	<b>Biogas Cubic meters Per year</b>	<b>KW</b>	<b>Metric Tons equivalent to CO2</b>
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2006	83,000	2,905,000	5,810,000	28,480
2007	95,450	3,340,750	6,681.500	32,752
2008	109,767	3,841,862	7,683,725	37,665
2009	126,232	4,418.142	8,836,283	43,315

Source: EECOPALSA

### By-Product of Solid Waste from Palm Oil (biomass)

EECOPLASA has also developed the technology of boiling the solid waste (biomass) of the African palm to produce electricity. Three MT of African palm fruit produce one MT of biomass. Approximately 3.5 metric tons of biomass can produce 3.5 mega watts of electricity per hour.

### 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. The sugar mills are waiting for an improvement in the global financial crisis, as well as biodiesel prices.

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 a potential of 344 Mw-h of electricity. They also sell electricity to the GOH's electric company ENEE. Due to the high price of oil, in 2008 one of the mills started to use 30,000 MT of coal during the non-harvest season of May-November. The coal is imported from Colombia. Other mills may do the same.

### Consumption

#### a) Biodiesel Consumption

Currently, there is no commercial biodiesel consumption in Honduras. There are five African palm oil processing plants and one tilapia by-product processing plant that utilize their internally produced biodiesel. The biodiesel powers generators, irrigation equipment and company vehicles. The biodiesel production and consumption is shown below:

<b>Biodiesel production/consumption/trade (liters)</b>					
	2004	2005	2006	2007	2008
<b>Biodiesel</b>					
Beginning stocks	0	0	6,120	13,620	19,620
Production*	0	76,120	753,794	1,021,876	1,362.501
Imports	0	0	0	0	0
Total supply*	0	76,120	759,914	1,035,496	1,382.121

Exports	0	0	0	0	0
Consumption	0	70,000	746,294	1,015,876	1,358.501
Ending stocks*	0	6,120	13,620	19,620	23,620

**Note:** The biodiesel production is not for commercial purposes.

## **b) 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.

### **Stocks**

Currently there are no commercial stocks of biofuels in Honduras.

### **Policy**

Honduras is the only Central American country that has a specific law on biofuels. The Regulation for this Law is in effect. 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), the Ministry of Natural Resources (SERNA).

SIC oversees the promotion, commercialization, distribution, and storage of biodiesel. In order to accomplish these tasks, SIC created the Biodiesel Technical Unit (UTB in Spanish). The UTB is integrated by representatives of SAG, SERNA and a representative of the Honduran Council of Private Enterprise (COHEP). SAG applies the law to promote research and the production of sustainable feedstock for the generation of biodiesel. Programs are implemented through incentives, promotions, and credits. As an example, SAG has obtained a loan to purchase improved African palm seeds from the Malaysian government.

The Biofuels Law provides funds to promote the production and transformation of feedstock to biodiesel. 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 funds are exempt 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 Regulation of the Biofuels Law has been approved. This Regulation provides a mechanism to define the mix of biodiesel with diesel and ethanol with gasoline. The process to set the blend will go through the following stages. First, SAG is logging an inventory of the biofuel and ethanol feedstock in Honduras. Second, SIC will forecast the

amount of biodiesel and ethanol to be produced from the feedstock. Third, based on a supply and demand analysis of biodiesel and ethanol, the UTB will set the blend at two, three or five percent. The biodiesel or ethanol will be targeted to the segmented markets in which they are produced. 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 biodiesel. The private sector is eager to take advantage of the law.

The UTB has hold meetings with car importers encouraging them to import flex cars using hydrated alcohol of 1800 cubic centimeters. The UTB and SERNA are developing a pilot project that will measure the impact on the environment from the use of ethanol. Hybrid cars will be imported from Brazil.

The GOH believes that biodiesel 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 1.5 direct jobs and 2 indirect jobs. If 1,000 hectares are planted and two percent biodiesel is added to diesel, 1,500 direct jobs and 2,000 indirect jobs could be created. In addition, biodiesel would bring opportunities to increase incomes in rural areas, reduce carbon dioxide (CO<sub>2</sub>) emissions and foreign exchange.

### **Marketing/International Cooperation Approach**

#### **United States/Brazil/Honduras:**

On March 2007, the United States and Brazilian government signed a Memorandum of Understanding (MOU) to advance cooperation on renewable energy, such as biofuels. The cooperation includes assistance to select countries to meet their domestic energy needs with locally-produced biofuels. The first countries chosen were Dominican Republic, El Salvador, Haiti and St. Kitts and Nevis. In November 2008, Honduras was chosen along with Guatemala, Jamaica, Guinea-Bissau and Senegal as part of the second tranche of the United States/Brazil Biofuels Initiative.

The initiative supports access to diverse, reliable and affordable energy. Biofuels is an important tool to ensure such access to dependable and cleaner sources of energy. The initiative will support feasibility studies, research, technical assistance and potential investment opportunities. All partners will be working to develop local biofuels industries to reduce dependence on imported fuels and promote sustainable development. The initiative may lead to increased investment, job creation, technology transfer and climate change benefits.

As part of the Initiative, in 2008, the Organization of American States (OAS) signed an agreement with Honduran independent sugar producers. The project will install small dehydrated ethanol production plants in the south part of the country. A feasibility study will be developed to define the quantity of ethanol that they will be producing.

#### **Honduras/Brazil:**

The GOH offered the Brazilian government to back the establishment of a regional office of the Brazilian Enterprise of Agricultural Research (EMBRAPA). EMBRAPA's scientists are conducting research on producing ethanol from sugar cane. The GOH believes that an EMBRAPA office in Honduras offers the following attributes: Strategic geographic location, high potential for agriculture and forestry, extensive biodiversity ecosystems, Ethno cultural diversity, Mesoamerican cultural identity, air, sea, and land facility access, and human resources. Honduras offered 200 hectares

at the CURLA campus, and 31 hectares for planting to create the “Regional Center for Innovation, Research, Training, and Technology Transfer in Sustainable Rural Development and Food Security.” In addition, it offered the six agricultural and forestry universities, the three regional agricultural schools, and the ten technical agricultural schools to provide support for the regional office.

#### **Honduras/Central America:**

In 2008, the Central American Customs Union developed the specifications of quality standards for biodiesel and ethanol. The agreement was recorded in the Central America Technical Regulation. The Technical Regulation for biodiesel was approved by the Economic Council of Ministers of Economic Integration (COMIECO in Spanish). The dehydrated ethanol regulation is pending to be approved by the World Trade Organization. The hydrated ethanol regulation is pending to be approved by Guatemala.

#### **Honduras/Colombia:**

The Colombian government, through an agreement with the Ministry of Agriculture and Livestock (SAG), donated a biodiesel plant with a daily production capacity of 10,000 liters. The plant will operate through an agreement between SAG and African palm producers associations. Research and development will be done through the Northern Regional Center of the University of Honduras (CURLA), FHIA and Zamorano University.

#### **Honduras/Europe:**

The German Development Service (DED) conducted a six-month experiment with biodiesel in 2007. The experiment featured six public transportation buses powered by biodiesel made from African palm. Through partnerships between investors and producers, DED is transforming bus motors so they can use jatropha biodiesel. The cost to transform a 35 passenger bus is between US\$1,500 to \$2,500. A jatropha processing plant is under construction.

The Dinant Corporation is applying its African palm/biodiesel technology to the *Jatropha curcas* plant. This venture is being developed with assistance from the Netherlands Development Organization (SNV) and the Honduran Enterprise Counsel of Sustainable Development (CEHDES). Program funds are provided to small producers of jatropha through a five year credit. The program is reaching 950 families from multiple ethnic groups. The producers receive technical assistance to develop a business model for production. The program will last two years and will result in about 4,000 hectares planted in jatropha. It is expected that by the year 2010, the production of *Jatropha* will reach 2,700 metric tons, and from which approximately 250,000 gallons of biodiesel will be produced.

Another jatropha project is being carried out by the Honduran NGO Foundation for the Agribusiness Rural Development (FUNDER). This project, “Green Drop,” is sponsored by six European organizations and the Honduran Research Foundation (FHIA). They are providing technical assistance to small producers on the selection of growing areas, growing techniques, motor adaptation, and commercialization of biodiesel. The objective of the project is to diversify production, create employment, increase income, reduce CO2 emissions, and promote the use of biodiesel.

#### **Honduras/United States:**

Technoserve, a United States Private Voluntary Organization (PVO), is conducting a *Jatropha* diversification program.

This program helps individual producers establish integrated farms that combine jatropha with dairy, cocoa or roots, and tuber production. By establishing four model farms (demonstration farms), Technoserve will build partnerships to study plant yields and management. Technoserve will also develop, and distribute a jatropha production manual adapted to Honduran conditions.