

## Jatropha In The Food Fuel Debate

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A combination of factors including the fuel crises of the seventies, global warming and the associated desert encroachment, among others, prompted the search for alternative energy sources. The feedstock for the first generation of biomass was sourced from food crops, a practice many considered unethical. *Jatropha* is non-edible and can thrive in an unproductive land. The cultivation of this second generation biomass may indirectly still impact on food availability in terms of competition with food crops for land, water and fertilizer. Hydro dams, geothermal, solar energy and wind turbine are some other renewable energy sources that their usage could, in one way or the other, effect food crop production. Without adequate planning and education, rural farmers may switch to *jatropha* farming at the expense of food crops. As the western countries set their renewable energy targets, it is hoped that unscrupulous business men would have the decency not to exploit the rural farmers by advising them to turn arable land into *jatropha* farms.

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### 1.0 Introduction

The search for alternative energy sources was prompted by a combination of factors. In the seventies there was the fuel crisis which hastened the realisation of the finiteness of fossil fuel. The political volatility in the regions from which most of the fossil fuels are sourced has added another dimension. Political and economic independence is the envy of all countries but this can only be guaranteed by energy independence or stable and readily available energy source. The need to reduce individual carbon footprint has had an added urgency to the search. Human activities in the form of deforestation and the burning of fossil fuels result to high concentrations of greenhouse gases and hence global warming. The alternative and renewable energy sources include solar, wind, tidal, geothermal and biomass. The first generation of biomass serve as food crop as well as feedstock. Cassava, palm oil, corn and sugar cane fall within this class. Switchgrass and *jatropha* are non edible and constitute the second generation of biomass. Although not edible this second generation does still compete with food crops for available land, water and fertilizer and may therefore indirectly impact on the ability of man to grow food plants to feed himself. *Jatropha* was first introduced in South America, by Portuguese traders. Villagers used it as a hedge crop, and some extracted oil and latex from the plants to make soap or fuel for lamps. The plant can live for up to 45 years. Indians as children recall using the latex from *jatropha* to blow bubbles (Barta, 2007).

The purpose of this study is to assess the impact of *jatropha* farming on world food production.

### 2. Other Renewable Energy Sources

For the whole issue to be put in its proper context, the contribution or otherwise of other renewable energy sources to man's ability to grow food and to feed himself should be briefly discussed. This is necessary because where any of them acts in combination with *jatropha*, the true effect of the later could be distorted.

The conventional construction of dam for hydroelectricity has the tendency to flood farming planes and displace communities living around the banks. The damming of the Yangtze River is estimated to have led to the displacement of about 1.4m people, submerging of ancient farmland, temples, wild life habitat and archaeological treasures dating back to ten thousand years ( Topping, 1995) . On the other hand, the 'Run of River' or small hydropower is an environmentally friendly solution to dam construction without the associated pitfalls. These plants can be installed almost anywhere that water runs. In comparison with the conventional hydropower, the run of the river is a very reliable technology, efficient, cost-effective with no adverse effect on food availability.

Compared with other biomass feedstock, algae can yield 30 times more biofuel per acre than land crops such as soybeans, corn and cassava. The U.S. Department of Energy has postulated why this is so: algae have a simple cellular structure, a lipid-rich composition and a rapid reproduction rate. Furthermore, the Department has estimated that if algae fuel were to replace all the petroleum fuel in the United States, it would require 15,000 square miles (40,000 km<sup>2</sup>), (Hartman, 2008) .and this is less than 1/7

the area of corn harvested in the United States in the year 2000 (EPA, 2008). Algae biofuel is in a strong position to resolve the conflicting demand between food crop and fuel source. Algae have a small footprint on land use and water requirement and indeed consume carbon dioxide as fertilizer. Algae can be grown in a closed-loop system making it possible to monitor and adjust all input factors when necessary. Algae 'eat' CO<sub>2</sub> but the same CO<sub>2</sub> is given up when the fuel is burnt therefore making the process carbon neutral. Algae production facilities are likely to be more acceptable to communities nearby since the potential for environmental pollution is less than the fossil fuel.

It is possible to convert tidal waves into energy and this can be used to drive turbines as in any other hydroelectricity. The beauty of tidal waves is that they are more easily predictable than solar and wind energies. In spite of their predictability, they are yet not widely in use, perhaps because of the complexities of engineering involved. The Rance River power station in France with a peak rating of 240 mW is the largest found in the literature (Wyle, 2012). The entire river was diverted during construction and progressively, the ecosystem of the river has been affected by silting since the facility was opened in 1966. If the land area used in diversion is recovered on completion, this energy source would hardly adversely affect food availability.

Geothermal power is derived from the heat stored below the earth surface. Extraction of this heat is achieved by drilling. Most available geothermal plants are located in areas near the tectonic plate boundaries. This form of energy is reliable, sustainable and cost effective. Geothermal wells do however release some greenhouse gases but much lower than those released by burning fossil fuels per unit power produced. There may be need to clean the surrounding land after drilling. Dissolved gases in geothermal hot water may contain traces of boron, mercury, arsenic, antimony and salts which can cause environmental pollution but these could be reduced by re-injecting the fluid back to the well. Geothermal systems can affect the stability of the land resulting in subsidence and earthquakes.

Solar energy and wind turbine do not appear to affect food production in any adverse way. For the wind turbine, there are still critics who argue that it defaces the environment, causes noise pollution and creates hazards to birds especially in wind farms.

Since sugarcane and corn are also edible plants the question asked is whether it is right to divert food crops for the production of fuel to provide transport to the rich when millions of people all over the world are hungry. This is a moral issue that should concern not only energy policy makers but also

bioenergy developers because of the social problems that can result as has been demonstrated in Mexico where in 2008 there was food riot by people who felt it was wrong to starve the poor in order to provide the energy to fuel and satisfy the luxury of the few (Vivas, 2012). The problem is exacerbated by the tax relief given to producers and the denaturing that makes the final product not edible. It may be advisable for other governments to follow the lead of Mexico who after the food riot outlawed the use of food crops in biofuel production. As a measure of its determination to discourage the production of biofuel from food crops, Mexico entered into partnership with Columbia to establish a \$1m non food crop jatropha processing facility. Proponents claim that jatropha, unlike corn and palmoil, grows wild and requires minimum maintenance in order to thrive.

### 3. The Bio Diesel

Bio-diesel production could have coconut or jatropha as the feedstock. Coconut, however serve also as a food crop. Sugarcane, cassava, corn, and sweet sorghum serve as food crop and have also been identified as feedstock for ethanol, a substitute blend for gasoline. Biodiesel is a clean burning, biodegradable, non-toxic alternative fuel produced through the transesterification process from renewable resources such as plant oil including jatropha. It can be blended with petroleum diesel to create a biodiesel blend. As a result of the beneficial social, economic, and environmental impact in the use of biodiesel, proponents argue, the product should vigorously be promoted. The production of feedstock from jatropha is bound to generate employment and additional income among those engaged in the farming. Unproductive lands that are not suitable for food crops can be turned into jatropha farm. The biofuel would help reduce greenhouse gas and hydrocarbon particulate emissions. There is no need to modify existing diesel engines in order to burn biodiesel. The biodiesel has better lubricating properties and a higher cetane value than the petroleum diesel (New W Energy, 2012 ). Jatropha is non edible and unlike the biodiesel from coconut does not suffer from the food-fuel dilemma. Biodiesel sourced from jatropha does not cause food price increases or shortages. Jatropha plant tolerates low rainfall and even drought. Jatropha planted from cuttings can bear fruit in as early as six months and if planted from the seedling will flower and fruit in eight months. The jatropha seed may contain more than 30% oil. It has been reported (Kanter, 2008) that in the first year, the Jatropha plant can produce about 600 kg / hectare rising in the third year to as much as 5,000 kg per hectare. In good soil with irrigation and management, its yields could reach as much as 10 tons/hectare . Jatropha production is labour intensive and therefore would generate

employment in the community. Countries that are currently net importers could turn to be net exporters of biodiesel products and this would bring about both energy and economic independence.

### 6.0 Price comparison

The competitiveness of biodiesel from jatropha can only be assessed by comparing the per barrel price with similar products. By some estimates, the per-barrel cost to produce biofuel using jatropha -- about \$43 -- is about half that of corn and roughly one-third that of rapeseed, two other leading materials for alternative energy. On the assumption that the cost of transesterification compares with that of refining crude oil, it will be safe to state (see table 1) that jatropha biodiesel would compete favourably with fuel made from crude oil without significant government subsidies.

Table 1 Estimated Cost Per barrel of Biofuel From Selected Stock at 2007 prices (Barta, 2007)

Biofuel Source	Price/barrel(\$)
Cellulose	305
Wheat	125
Rapeseed	125
Soybean	122
Sugar beet	100
Corn	83
Sugar Cane	45
Jatropha	43

### 7.0 Test Flight

Some in the aviation industry believe that one day by using biofuel the biggest jets would be flown across the world without contributing to climate change. If there is the need to modify or completely convert fueling facilities, the aviation industry would be less costly compared with land transport fueling systems because of the fewer number of airport refueling facilities. Air New Zealand has joined other airlines in the trial run of biofuel on the jet engine. The Airline conducted a two-hour test from Auckland International Airport where the crew sought to test how the fuel made from jatropha plants and blended 50:50 with Jet A1 fuel in the tank of one of four Rolls-Royce engines on a 747-400, perform at high altitudes and in other demanding conditions. The results were to be reviewed as part of the effort to have jatropha fuel certified as aviation fuel. It is hoped that the industry keeps to its promise to use sustainable biofuels that do not threaten food and water supplies. It would appear that part of the industries carbon sequestration plan is to shift as much as possible fuel usage from the conventional to biofuels. The jatropha used by Air New Zealand for

the test flight was sourced from Malawi, Mozambique, Tanzania and India, and was from seeds grown on environmentally sustainable farms. The airline said each jatropha seed produces between 30 and 40 percent of its mass in oil and further confirmed that the plant can be grown in a range of difficult conditions not suitable for traditional food crops. Air New Zealand also explained that the criteria for sourcing the jatropha oil required that the land was neither forest land nor virgin grassland within the previous two decades. The quality of the soil and climate was such that the land was not suitable for the vast majority of food crops. Furthermore, the farms the jatropha was sourced were rain-fed, not mechanically irrigated (Kanter, 2008). Opponents wonder whether other commercial jatropha growers would heed the Air New Zealand lofty approach? There is no guarantee that they would.

### 4.0 The Rural Farmer and Jatropha

The use of jatropha as a source of biofuel may be regarded as a mixed blessing. A group of rural farmers has, no doubt, benefitted from planting jatropha whilst the other group has either been exploited in the leasing of land for jatropha plantation or impoverished by heeding the advice to switch to jatropha farming with projected yield falling short of expectation. Although Goldman Sachs recently cited jatropha as one of the best candidates for future biodiesel production, more cases of exploitation of poor rural farmers are likely to arise as more countries in the west set their biofuel targets. For example, a Bear Stearns analysis found that U.S. farmers only have the capacity to replace about 7% of the country's gasoline with corn-based ethanol, despite a new federal renewable-fuels target of 15% by 2017. To meet that goal, the U.S. would likely have to find a lot more land. If more land cannot be found within, the likely scenario is to export the make-up sourcing to poorer countries of the world and the incentive to do this is quite high since the cost of land lease and labour are low in developing countries. Unscrupulous speculators are already abusing this in developing countries. The collapse of the company, Sun Biofuels is one of such cases which reported to have left hundreds of Tanzanians not only jobless and landless but also desperate and hopeless for the future (Carrington, 2011). The case involving the Indian Railways appears to be better planned and managed. To the satisfaction of jatropha advocates who argue that vast infertile wasteland be turned into jatropha farms without environmental distress, the Indian Railways have complied. The Indian State railway ministry is reported to have planted along its tracts some 7.5 million jatropha trees and is using the biodiesel to run some of its locomotives (Barta, 2007).

But unlike other biodiesel crops, jatropha can be grown almost anywhere -- including deserts, trash dumps, and rock piles. It doesn't need much water or fertilizer, and it isn't edible. That means environmentalists and policy makers don't have to worry about whether jatropha diverts resources away from crops that could be used to feed people.

Even though jatropha is not edible and hence does not enter directly into the food-fuel debate what happens if the jatropha industry fails to materialise? Where will the poor farmer who may have invested heavily on jatropha farming find himself? It is still far from clear whether jatropha farming is economically viable on a large scale and that is the risk. The jatropha plant oil output is still unpredictable and may be lower than expected. Although it can grow without water, it tends to do much better when water is added, raising its cost of production and mitigating some of the perceived benefits. Proper planning is necessary to ensure the poor farmer does not put "all his eggs in one basket" by planting jatropha at the expense of other food crops. This could lead to a number of adverse results: the poor farmer could be left poorer and the food situation worsened.

### 5.0 The Arguments - For and Against

Opponents and critics to jatropha farming are pointing out that some farmers have already reported financial losses from jatropha plantations after their crops yielded less oil than expected or buyers failed to pay sufficient prices. This group insists that subsistent farmers would end up serving as guinea pigs for an untested industry. The critics who have taken issue with biofuel argue that biofuel production would lead to unintended consequences, expand deforestation, compete and raise price of food crops.

There is already concern that the food situation would worsen with governments setting targets for the production of biofuels. The land, water and fertilizer may not be able to cope with the extra demand for biofuel plants without significant social and environmental consequences. The requirements for growing jatropha (low water and virtually infertile land), may be crucial in cushioning out the consequences of alternative energy boom currently sourced from food crops such as corn, cassava and palm oil. It takes huge quantities of land, water and chemicals to grow these food crops from which ethanol and biodiesel are made.

The allure to Jatropha is high. Planting more palm oil, corn or other crops to make ethanol or biodiesel isn't really an option due to land shortages and other constraints. Water tables are falling, and production of some key commodities like rice are already flattening out fast. The whole world could

have trouble meeting its own food needs even without diversion to biofuel.

Mr. Bassey chairman of Friends of the Earth (FOE, 2009) in Ghana, a non-governmental environmental organisation in his contribution to the debate to jatropha and other biofuel farming challenged attempts to encourage the farming of jatropha and other agricultural-based renewable energy biofuel plants at the expense of food production. The chairman believes that it would further deepen food and water crises, sanitation problems, poverty and land tenure difficulties especially in Africa.. He further argues that the scramble for so called marginal lands for the cultivation of Jatropha and other crops for bio fuel should be resisted. He contends that the drive for biofuel is a major factor that has between 2008 and 2009, contributed to food crisis worldwide. The chairman further cited the case in Swaziland, where the farmers found contrary to advice from a company called D 1 Oils Jatropha, that the plant really needed plenty of water to thrive. Other sources of renewable energy such as solar and wind power without biomass, should be explored.

Ms Cheryl Agyepong, Programme Co-ordinator of FOE admitted that the drive for biofuels as alternative renewable energy had increased as the world was running short of fossil resources. In her contribution to the debate Ms Agyepong expressed dissatisfaction with so many biofuel crop farms earmarked for Africa and frowns at the belief in Europe that Africa and Asia have vast marginal lands. The European Union according to her has set a mandatory target of 5% motor fuel from biofuel by 2010 while by 2012 the US is aiming at 28.4 billion litres contribution from biofuel. Furthermore, quoting the world bank economists she stated that in the year 2008, biofuel accounted for 75% of global food price increases. In South Africa today, there are huge tracks of land which have already been set aside for bio fuel production. What makes one to worry is the fact that these are sugarcane plantations-sugar which could be used as food but due to the pressure from the west, this sugar is turned into a source of biofuel.

Proponents may argue however that there is enough land for both food and cash crop, that the problem lies with effective planning. However, it will be pragmatic to examine the situation in each country. In some countries for instance, where there are plenty of land and enough water, jatropha plantation could be considered. Properly planned and implemented, a project of this nature can help to halt desert encroachment, control soil erosion and create employment for the people. Such country may even be in a position to sell Carbon Credit. The use of

Jatropha-based fuel is carbon neutral since the CO<sub>2</sub> emitted is recycled in the growing of the feedstock.

In his contribution to the debate the CEO National Biodiesel Board in the US attributed the cause of food price increase to the greed of the Grocery Manufacturers Association (GMA). He accused the association of relentlessly driving the “food vs. fuel” debate and that it was nothing but a smokescreen to divert attention from the unjustifiably huge profits of the food companies. An scapegoat has to be invented by the association and how convenient to use biofuel especially as it is not yet fully understood by the people.

### 8.0 Conclusion

- 1.0 Without adequate planning and education, Jatropha, although non edible second generation biomass could still compete for land, water and fertilizer with food crops
- 2.0 The per barrel price of biodiesel from jatropha compares favourably with those of other biomass fuels but to ascertain competitiveness the cost of transesterification will have to be factored in
3. The food shortage situation could get worse as the Western countries set the renewable energy contribution target to their overall energy mix, if the production burden is placed on developing countries as this would exacerbate the already food shortages in these regions.
4. With proper planning and education, the rural dweller can benefit from jatropha farming
5. As part of the efforts for carbon sequestration, the airlines including Air New Zealand, are testing the use of biofuel from jatropha as aviation fuel.

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