

# The economic potentialities of *Jatropha curcas* in Mali

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## Abstract

*Jatropha* also called “Bagani” in Bambara (that is to say “Poison”). The origin of *Jatropha Curcas* remains controversial as it can be found over a wide range of countries in central and South America in humid forest, tropical dry forest. *Jatropha Curcas* is a multi-purpose plant species, with many advantages for biodiesel production. *Jatropha Curcas* a shrub species of family Euphorbiaceae has been recognized as a promising biofuel plant for reducing greenhouse gas emissions. It has received much attention as a potential source of vegetable oil as a replacement for petroleum, and in particular, the production of biodiesel. Various parts of *Jatropha Curcas* are globally used for healthcare management of plants, human being and domesticated animal. Besides ethnomedicinal usages, this species has much economic and ecological importance.

**Keyword:** *Jatropha*, biofuel plant, biocarburant, medicinal, environment

## Introduction

*Jatropha* is an ancient plant, its origin is nevertheless controversial since some authors locate it in the dry regions of Brazil while for others it would rather be central America or Mexico. It seems that it is this last origin which is officially retained. *Jatropha curcas* (L.) is a perennial plant of the spurge family (Euphorbiaceae). Recently, it has received much attention as a potential source of vegetable oil as a replacement for petroleum, and, in particular, the production of biodiesel.

It seems that the plant was introduced in the 16th century to the Cape Verde Islands by Portuguese sailors and then in Guinea Bissau to then spread to Africa and Asia. *Jatropha Curcas* is a versatile species extracted from its leaves, bark roots, seeds, and latex. *Jatropha* exhibits different medicinal properties that are important to animals and humans. It is a perennial shrub with an estimated 40 years productive life cycle. Its yield potential is 5t/ha of seed.

*Jatropha* also called Pourghère or « Bagani » in Bambara (that is to say Poison) is a shrub of the Euphorbiaceae family. Containing a toxic constituent it is not consumed by livestock hence its use as a hedge against animals and to control water and wind erosion. From 2007 the cultivation of *jatropha* has grown significantly in Mali because of its use as agro-fuel following the increase in oil prices.

A growing concern for the protection of the environment has led developing countries like Mali to find an opportunity to reduce their dependence on imported oil and generate profits through the production of biofuel. The government of Mali has developed a strategy to promote the production of biofuel, in particular *Jatropha*. The economic and environment stakes surrounding this strategy are far from negligible.

The year 2011 was marked in Mali by a sharp rise in oil prices. This forced the Malian authorities to consider liberalizing the energy sector in terms of both imports and

production. Energy is a determining factor in the social and economic development of any Community,

Since it has always been used by man to meet of existence in terms of improving the living environment and increasing productivity (heating, lighting, transport and production of driving forces for the creation of wealth). We are a time when the international community is committed to reducing greenhouse gas emissions from fossil fuels.

Apart from its use in traditional pharmacopoeia. *Jatropha* has always been used for the quality of its oil. The oil is extrated from the harvested seeds by processes of boiling the almonds in water. The oil has medical uses and is mainly used to make soap or for lighting as a replacement for petroleum.

## Origin and Taxonomy

### Origin

The *Jatropha* or « Barbados morning plant » which can reach eight meters in height its is part of the Euphorbiaceae familiers. It is an oilseed shrub with over 3.500 species grouped into 250 types. It is native to Mexico and central America, but grows in most tropical countries. It is cultivated in central America South America, Southeast Asia India and Africa.

### Taxonomie

Family : Euphorbiaceae  
Subfamily : Crotonoideae  
Order : Euphorbiales  
Class : Magnoliopsida  
Subclass : Rosidae  
Genus : *Jatropha*  
Species : *Curcas*

## Morphology

It is a large, fast growing tree with a normal height of two to three meters. Under specific conditions it can reach up to eight meters. Its gray to reddish bark is marked with white spots. The main trunk is quite short and thin, greyish to reddish in color with white spots.

### Root

*Jatropha* has shorts, sparsely branched roots. Normally seeding can have five roots, one central and four on the

periphery (two secondaries and two tertials). By developnig from vegetative (asexuals) material the new plant does not have a taproot and the forming roots are inserted shallowly.

### Stem

There is no uniformity in the growth of the stems. For example the native variety has a straight stem without much branching and also the shape of the leaves is different. The branches contain latex-supple when they are young they become brittle with age.

### Sheets

The leaves are green broad long and alternate in the shape of a heart. They are normally formed from 5 to 7 lobes, shallow and large, with long petioles swelling at its base by to 10 to 15 cm ending in a lobed blade. The venation of the lamina is webbed. *Jatropha* is a tree with seasonal falling leaves (deciduous) according to Cortesao (1956). *Jatropha* leaves are simple alternate and exhibit a spiral phyllotaxis

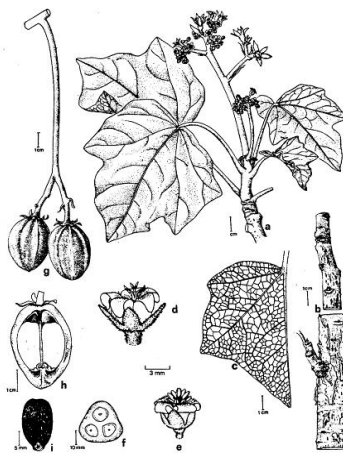


Figure 1 : Important parts of *Jatropha Curcas*

a : flowering branch ; b : bark ; c : leaf veins ; d : female flower ; e : male flower ; f : cut of a green fruit  
g : fruit ; h : longitudinal section of a fruit ; i : seed (Aponte and Deghan 1994)

## Flower

The plant is monoecious with a unisexual flower presenting male and female organs, the inflorescences are terminated in leaves on the branches (cyme). Usually a female flower is surrounded by male flowers

The flowers are small (6 to 8 mm) greenish yellow in diameter and pubescent. Its flowering is linked to the rainfall regime. The propagation of *Jatropha* can be carried out by seed or by cutting. There may be up to five blooms each year, but only two of them are the most relevant flowering, the first occurring between May and June, and the second

between August and September. Figs 1 and 2 allow you to see the different organs of the plant.

Under suitable conditions the flowering period lasts 3 to 5 days for female flowers, and 12 to 14 days for male flowers. Normally the number of female flowers is lower than that of male flowers.

The fruit is trilocular (divided into three parts) with a seed in each cavity. It is formed by a pericarp or a hard, woody, indehiscent skin (which does not open to release the seed). Until maturity it is green first changing to yellow, then brown and finally black when it reaches maturity.



Figure 2 : Fruit development of *Jatropha Curcas* (Jose Angel Alfonso Bartoli)

## Seed

The seed is relatively large. When dry, it measures 1.5 to 2 cm in length and 1.0 to 1.3 cm in diameter. There is a white skin under the seed jacket (tegument) covering the almonds containing an embryo with two long, flat cotyledons. The

seed used for dissemination should be selected for good productivity. Germination of the seed lasts 15 days and can even start from the fifth day. Seed storage should not exceed 10 to 15 months, guaranteeing its quality taking into account its oil content.



Figure 3 : *Jatropha curcas* Seed (Jose Angel Alfonso Bartoli)

## Why choose *Jatropha* ?

- Supply of renewable energy that offers possibilities for reducing greenhouse gases (GHG).
- Poverty reduction (sale of seeds and oil jobs)
- Maintenance of soil fertility (living hedges and recovery of oil cakes)

## Objectives for the development of *Jatropha* Culture

A consequent development of the cultivation of biofuels aimed to :

- ✓ Independence from the country's energy supply from hydrocarbons and reduction of the national energy bill.

- ✓ Sustainable contribution to the national economy by developing endogenous energy resources.
- ✓ Support, revitalization and improvement of the quality of life in rural areas, while respecting food security and environmental protection.
- ✓ Creation of jobs, reduction of poverty in rural areas through the development of Jatropha vegetable oil production sectors.

### **Environmental Impact**

While Jatropha has potential interests for biofuel production by providing additional income to rural communities the question of the potential impact of this crop on the environment must be taken into account.

### ***Jatropha And Biodiversity***

Worldwide, many countries have classified Jatropha as an invasive plant (Lowat et al.2007). In some countries such as Western Australia the Comores Archipelago and Eastern Mozambique, where its presence is considered problematic. The invasive nature of Jatropha depends on the pedoclimatic conditions of the areas considered. The difficulty in controlling the Jatropha led Western Australia to ban its cultivation in 2006.

The question of the difficulty in controlling its expansion may however arise in the event of this crop developing on a large scale. Increase in phytosanitary risks on food crops with the massive use of phytosanitary products which can have an impact on the local fauna of these areas. These risks can also come from the cultivation of large areas which would present an increased risk of massive infestation by pests and diseases. However Jatropha monoculture over large areas would be prone to these attacks.

### ***Protection of the plant***

Reduction of greenhouse gas emissions by planting Jatropha and using Biodiesel.

- Biodiesel is a clean fuel.
- Fight against climate change by questering atmospheric carbon in the plant and in the soil.
- Control of Wind erosion improvement of water infiltration recovery of non-cultivable land and reforestation.
- Substitution for fossil fuels.

### ***Opportunities***

- Non-irrigated crops.
- Conservation of biodiversity.
- Erosion control.
- Improved soil water retention

### **Medicinal properties of JATROPHA**

The Ferruginous or Indian pine nut (*Jatropha Curcas L.*) is a multiple use species of Euphorbiaceae used by rural populations in traditional medicine.

The origin of the name Jatropha (Jatros = doctor and tropha = food) point to an important use of this plant for medicinal purposes.

In traditional pharmacopeae, Jatropha is used for many ailments. The oil, leaves and bark are used as a purgative. It helps treat rheumatism and all kinds of dermatological infections.

The latex is known to treat wounds, ulcers, dermatomycosis, scabies and also to relieve against insect bites. Jatropha latex contains alkaloids, cocaine and jatroham which play an important role as anti-cancer agents (Thomas et al. 2008), and the roots are said to be used as an antidote against snakebites.

The leaves are used as a decoction against malaria, high blood pressure or to increase milk secretion in women. Fruits help in the treatment of hypertension. Roots are used to treat dysentery, syphilis

### **Biocidal properties of Jatropha Curcas**

Given the wide distribution of this plant and the presence of toxins in most of its constituents, the biocidal properties of Jatropha have drawn the attention of users and their scientists to fight against predatory insects of crops or against vectors diseases. This is how mosquitoes (vectors of many diseases) have been targeted as well as molluscs that transmit bilharzia of which there are several species.

### **Extraction of Jatropha Oil**

Traditionally, Jatropha oil has been extracted by simple processes, first the seeds are shelled and then the almonds are boiled in water. The oil supernatant in the container was then easy to collect. For the extraction of oilseeds for commercial purposes, mechanical pressing or solvent extracts between 90 and 95% of the oil from the seed with a press and the second 99% (Shahidi 2005). The oil is not edible, even toxic due to its phorbolic ester content, but it is an excellent biofuel lampante oil and a raw material for soap production. To obtain liter of oil, you need 5 kg of seed.

### **Economic impact of biofuels in Mali**

Jatropha appeared in Mali in the 1930 under the french presence, but its development mainly took place thanks to the initiative of German technical cooperation (GTZ) which carried out a set of projects in the country from 1987.

The experience that followed helped to better grasp the potential of this plant, but its large-scale exploitation has taken place through many projects and initiatives such as the Mali Folkecenter project located in the Sikasso region.

These projects have enabled the plantation of 530 ha, which primarily targets rural electrification. The Mali biofuel project which aims to supply the local market.

**Table 1** : Area covered by Jatropha in Mali

Aires	Surface (ha)-2008	% des producteurs		
Kita	1300.00	34.5%	1313.00	42%
Koulikoro	1300.00	34.5%	1017.00	32%
Garalo	430/00	13%	530.00	17%
Yorosso	700.00	18%	300.00	9%
Total	3730.00	100%	3160.00	100%

(Source Fauveaud s. 2009)

To respond to a constant demand, government action continued with the establishment of ANADEB (National Biofuels Development Agency) whose missions are specified in its creation decree of March 4 2009.

- Participate in the definition of biofuel standards and in monitoring their implementation.
- Ensure the permanent availability of biofuels on the market.
- Establish the bases and pricing mechanisms and participate in the development of the price structure of biofuels.
- Ensure consultation between national and international partners in the field of biofuels to promote technological exchanges and develop partnerships.

With the development of this plant, the country could replace a significant part of these diesel imports, especially with locally produced oil, as the Mali bioenergy project dreams of doing. Certain by-products resulting from the extraction of Jatropha oil have real potential, like the cake which, once freed of its toxins by means of intensive heating, can be used as fertilizer for farmers, sediments that go into making soap and sap that can be used as inks for paper.

## Conclusion

A plant growing in semi-arid regions, Jatropha gave rise to hopes a few years ago of being an alternative to oil in some countries, notably Mali, thanks to the oil extracted from its seeds. Since 2006-2007, Jatropha cultivation has boomed in Mali for use as biofuel, following the increase in oil prices. The transformation of Jatropha seeds into soap is an essential activity of women.

As such, renewable energy resources will have a key role to play because they should make it possible to achieve three objectives simultaneously:

- Reduction of energy expenditure and therefore improvement of the trade balance.
- Potential for reducing polluting emissions.
- Diversification of agricultural production.

Finally, a positive dynamic of the entire value chain of the Jatropha sector should be envisaged in the long term thanks to a "snowball" effect of the initial development of Jatropha on employment in rural areas and energy independence,

thus opening up the way to an autonomous dynamic of production.

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