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JATROPHA CURCAS L. (RATANJOT) EUPHORBIACEAE: AN BIO-FUEL PLANT

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Abstract:
Biodiesel, an eco-friendly diesel fuel similar to petro-diesel in comustion properties. *Jatropha curcas* Linn. is perennial shrub belongs to Euphorbiaceae family. It is a non edible plant but it have great potential for biodiesal. The present paper is an attempt to provide a detailed Botanical description, Taxonomical position, Ecological condition, Possibility of plantation in Rajasthan of *Jatropha curcas*.

Key Words: Eco-Freindly, Biodiesal, Biofuel & Sustainability

Introduction:

India ranks sixth in the world in terms of its energy demand and its economy is growing at a rate of 8-9 percent per annum. Even today, 72% of petroleum requirement is fulfilled by oil imports. This is a matter of serious concern for the country. Therefore attempts needs to be made to reduce reliance on imports and achieve better alternative sources of energy which are suitable and sustainable for the better health of the environment [1]. In order to foster energy security, India's strategy is to focus efforts toward energy self-reliance and developing renewable energy options. In this context, India proposed an indicative biofuel blending target of 20 percent for both bioethanol and biodiesel by 2017 (B20 target) [2]. Biofuels are considered in part, a solution to such issues as sustainable development, energy security and a reduction of greenhouse gas emissions. Biodiesel, an environmental friendly diesel fuel similar to petro-diesel in comustion properties, has received considerable attention in the recent past worldwide. Biodiesel is a methyl or ethyl ester of fatty acid made from renewable biological resources such as vegetable oils (both edible and nonedible), recycled waste vegetable oil and animal fats [3], [4], [5].

Jatropha curcas L. was identified by the Indian government as one of the most suitable biodiesel feedstocks, since it is able to grow on marginal land and yields high-quality oil suitable for energetic use [6]. *Jatropha curcas* Linn. is perennial shrub belongs to Euphorbiaceae family same as rubber tree and cassava [7]. The *Jatropha curcas* Linnaeus plant originated from Mexico and was spread to Asia and Africa by Portuguese traders as a hedge plant [8]. It is a non edible plant that was recently discovered to have great potential as feedstock for biodiesel and also biolubricant production [9]. Plant oil based lubricants can be attractive to global consumers because of its environmental benefits and the fact that it is made from renewable resources. Jatropha oil is considered non-edible oil due to the presence of toxic esters [10]. Thus, it could provide an alternative of sufficient supplies of low cost feedstock for fuel oil and its derivatives with no competition with food uses [11].

Taxonomic Position:

Kingdom	:	Plantae
Order	:	Malpighiales
Family	:	Euphorbiaceae
Genus	:	Jatropha
Species	:	*J. curcas*

Ecological Conditions:

Jatropha curcas grows in tropical and subtropical climates across the developing world, and is often cultivated as a hedge crop. It grows rapidly and requires minimal water and nutrients, and is able to grow on barren land under harsh conditions and poor quality or degraded land [12]. Temperature is the main factor that affects the cultivation of *Jatropha*. About 95% of the *Jatropha* cultivation is found in the land where the annual rainfall is above 600 mm and annual temperature range of about 20 to 27^{o}C [13]. So, It is deciduous, a mechanism that limits water loss and minimizes the effect drought, which is manifest by the abscission of the leaves. Being deciduous is an important evolutionary mechanism, because it increases the possibility of survival and production under times of severe drought, which are typical of arid and semi-arid regions. The deciduous period takes place during the winter and signals pruning time, when the metabolic activity of the plant declines significantly. During its life which is of the order of 50 years, *Jatropha* plant requires very little water as compared to other cash crops.

Botanical Description:

Jatropha curcas is a shrub-tree that can reach a height of 5 m during cultivation, formed by juicy multi-branched stem. The plant is monoecious, with the inflorescences in chapters appearing at the extremities of the branches, a characteristic that shows the importance of winter pruning the cultivation. Besides promoting

rejuvenation, pruning significantly increases the number of branches and, consequently, the number of inflorescences.

Figure: Seed of *Jatropha curcas* (Ratanjot)

The inflorescences appear in the beginning of the rainy season and produce unisexual male and female flowers and, occasionally, hermaphrodite flowers. There are 3 or 4 flows of blooming during this period. The fruits, containing an average of 3 seeds, ripen non-uniformly in approximately 60 days, and they acquire a yellow and dark brown color at harvest time. The root system is formed by up to 4 lateral roots and a taproot, which can reach 5 m in depth [14], [15], [16].

***Jatropha curcas* in Rajasthan:**

Rajasthan is situated between 23°3' N and 30°12' N latitude and 69°30' and 78°17' E longitude. The total land area of the state is about 3, 42,239 km2, out of which about 1, 96,150 km2 is arid and rest is semi-arid. The experience shows that plantation has been successful in the drier regions of the tropics with annual rainfall of 500-600 mm but for production purposes 900-1200 mm rainfall or irrigation is needed [17].

Only six districts of Rajasthan which are most suitable for *Jatropha* plantation and land with scrub and land without scrub for plantation. The districts as per the rainfall potential for growing Jatropha are Bilwara, Banswara, Udaipur, Pali, Rajsamand, Pratapgarh and Sirohi. In district like Hanumangarh, Sri Ganganagar, Bikaner, Bharatpur, Churu, Nagaur, Sikar, Barmer, Jaisalmer, Jhunjhnu, Jalore, Tonk, Swai-madhopur and Jodhpur where temperatures in winter can reach up to 1˚C and in summer temperature becomes 48˚C, no possibility of *Jatropha* plantation. These districts observe series of hazy days in winter which destroys the plants and even regular irrigation cannot provide life to the plants. In all these 14 districts, annual rainfall is less than 600 mm, no possibility of survival of plants [18].

Uses:

As on today the total diesel fuel demand in India is 66.9 Million Metric Ton (MMT). If engine is to be operated with 20% mixing with *Jatropha* oil with diesel, which is most suitable replacement of diesel fuel without losing engine efficiency, the biodiesel requirement would be 13.38 MMT. For the required production, requirement of waste land would be 11.19 M ha [18]. The oil extracted from the seeds of the *Jatropha* plants can be used either directly or converted into biodiesel which is very similar to conventional diesel fuel. The method used to convert these oils to biodiesel is called trans-esterification. India's total biodiesel requirement is projected to grow to 3.6 Million Metric Tons by 2011-12 [19]. Rajasthan economy is mainly depended upon live stock. Among them most prominent is the Goat. *Jatropha* is not gazed by animals including Goat and serve as a live bio-fence around fields. Due to its toxicity, the plant also possesses medicinal properties to induce diarrhoea and regurgitation [20]. Seeds may also be used for medicines, and industrial raw material for soap and cosmetics production.

Conclusion:

In view of environmental considerations, bio-diesel is considered carbon neutral because all the CO_2 released during consumption had been sequestered from the atmosphere for the growth of plants. As a clean renewable energy, it has zero emission of carbon dioxide, causing almost no environmental pollution. The authors wanted to discuss future research opportunities through the present review in the form of its comprehensive information.

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