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Jatropha curcas L.: A crucified plant waiting for resurgence

Sheikh Adil Edrisi [a], Rama Kant Dubey [a], Vishal Tripathi [a], Mansi Bakshi [a], Pankaj Srivastava [b], Sarah Jamil [b], H.B. Singh [c], Nandita Singh [b,**], P.C. Abhilash [a,*]

[a] Institute of Environment & Sustainable Development, Banaras Hindu University, Varanasi 221005, UP, India
[b] Eco-Auditing Group, CSIR-National Botanical Research Institute, Lucknow 226001, UP, India
[c] Department of Mycology & Plant Pathology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221005, UP, India

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ABSTRACT

Jatropha curcas L. (hereinafter Jatropha) is often considered as a magical biodiesel plant with multitude of environmental benefits and therefore, the plantation of Jatropha has been done on a global scale without crop improvement, proper field validation, standardization of agronomic practices and high quality certified planting materials. Importantly, the seed yield and oil content of the species were not validated before the field introduction. Moreover, farmers are not aware of the biology and ecology of Jatropha and even not aware of the pest incidence and common diseases in Jatropha. As a result, there was a total mismatch between the expectations as well as the real performance of this species under field condition. Therefore, the present article is aimed to critically analyze the actual reasons behind the failure of Jatropha in field conditions and recommend suitable strategies for the future utilization of this plant for sustainable biofuel program.

Contents

1. Introduction

Jatropha is a tropical oil bearing plant widely recognized as a potential feedstock for biodiesel production [1–10]. It is native to Mexico and Central America and distributed in Latin America, Africa, India and South East Asia [2–5]. The plant is well adapted to arid and semi-arid climatic conditions and can grow in different type of lands including marginal, degraded and contaminated lands [14]. The multiple attributes and biodiesel production potential of Jatropha have been extensively covered in various literatures [1–23]. Moreover, the prospects and promises of Jatropha biodiesel program in various countries have been reported by many researchers [22,24–28]. Because of its envisioned environmental benefits, large scale plantations of Jatropha have been done in Asian (especially in India and China), African and Latin American countries [23,24]. Irrespective of the geographical context, the cultivation and popularization of Jatropha in above regions have been mooted by three important ethos such as (i) achieving energy security, (ii) revitalizing marginal and degraded lands (commonly called as wastelands) and (iii) alleviating rural poverty through employment and sustainable biofuel production (Fig. 1) [1,29,30]. For the purpose of this

* Correspondence to: Institute of Environment & Sustainable Development (IESD), Banaras Hindu University, Varanasi 221005, UP, India. Tel.: +91 9415644280.
** Correspondence to: Eco-Auditing Group, CSIR-National Botanical Research Institute, Lucknow 226001, UP, India.
E-mail addresses: nanditasingh8@yahoo.co.in (N. Singh), pca.iesd@bhu.ac.in, pcabhilash@hotmail.com (P.C. Abhilash).

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discourse, a sustainable biofuel production program can be defined as a program that not only provides a continuous and steady supply of biodiesel but also contributes substantially for the ecological, economic and societal development through waste land reclamation, managing local biodiversity, soil quality improvement, job creation and providing entrepreneurial opportunities.

A Scopus based literature survey (http://www.scopus.com) shows that more than 180 reviews on Jatropha has already been published in various research journals. As in the case of other research outlets, RSER has also paid considerable attention to Jatropha and this can be evidenced from the fact that more than 21 reviews on Jatropha has been recently appeared in RSER (Table 1). In fact the reviews covered a wide spectrum of topics such as the general, socio-economic, environmental and sustainability aspects of Jatropha cultivation [2,31–35]; comparative studies on the performance evaluation of Jatropha biodiesel [36–38]; biotechnological approaches for improving Jatropha

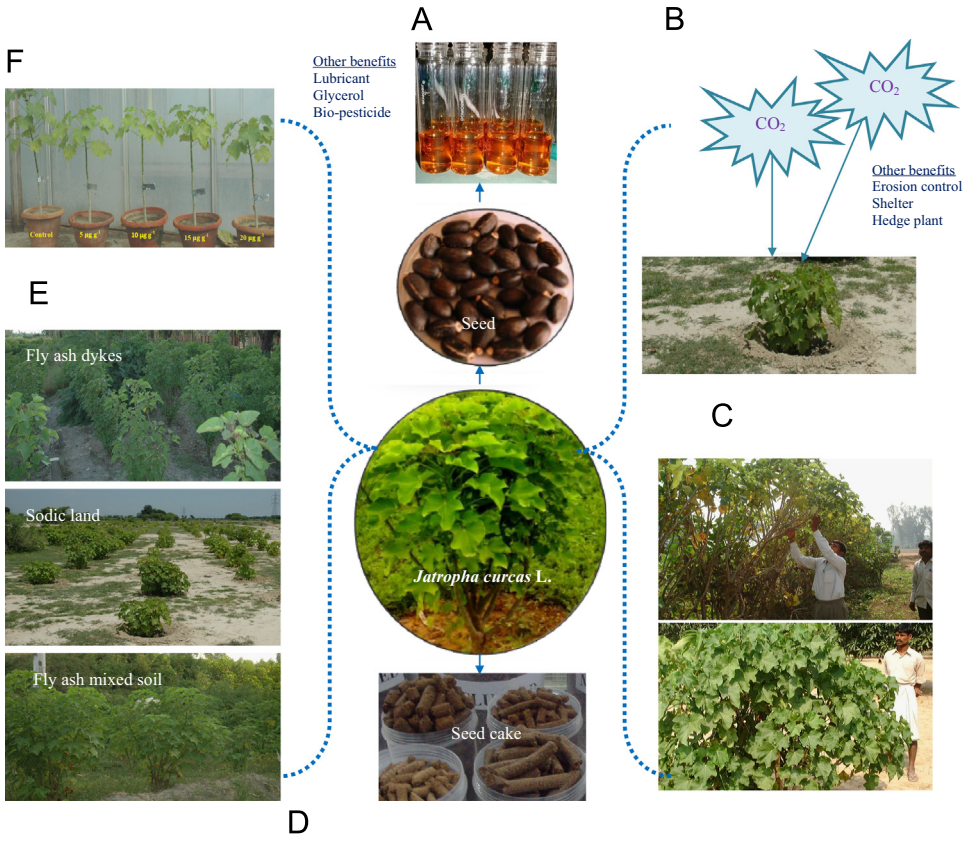

Fig. 1. Multiple attributes of Jatropha suitable for a sustainable biodiesel program. (A) Biodiesel production, (B) Soil carbon sequestration, (C) Rural income and employment generation, (D) Seed cake can be used as a biofertilizer and for biogas production, (E) Restoration and management of wastelands/ degraded lands and (F) Phytoremediation of pesticide.

Table 1
Latest publications on Jatropha published in renewable and sustainable energy reviews.

Sl. no.	Title/topic of the review	Year	Ref
1	*Jatropha curcas*: a ten year story from hope to despair	2014	[24]
2	Global experience with Jatropha cultivation for bioenergy: an assessment of socio-economic and environmental aspects	2014	[31]
3	Comparative studies on performance evaluation of DI diesel engine with high grade low heat rejection combustion chamber with carbureted alcohols and crude Jatropha oil	2014	[39]
4	Performance evaluation of medium grade low heat rejection diesel engine with carbureted methanol and crude Jatropha oil	2014	[40]
5	*Jatropha curcas* as a renewable source for bio-fuels – a review	2013	[32]
6	A Jatropha biomass as renewable materials for biocomposites and its applications	2013	[43]
7	Status of molecular breeding for improving *Jatropha curcas* and biodiesel	2013	[41]
8	A global comparative review of biodiesel production from Jatropha *curcas* using different homogeneous acid and alkaline catalysts: study of physical and chemical properties	2013	[33]
9	Land availability of Jatropha production in Malaysia	2012	[49]
10	Prospects of biodiesel from Jatropha in Malaysia	2012	[48]
11	*Jatropha curcas*: a potential biofuel plant for sustainable environmental development	2012	[34]
12	Review and prospects of Jatropha biodiesel industry in China	2012	[44]
13	Risk management for *Jatropha curcas* based biodiesel industry of Panzhihua Prefecture in Southwest China	2012	[45]
14	Sustainability issues for promotion of Jatropha biodiesel in Indian scenario: a review	2012	[45]
15	A review of biodiesel production from *Jatropha curcas* L. oil	2011	[35]
16	Comparison of palm oil, *Jatropha curcas* and *Calophyllum inophyllum* for biodiesel: a review	2011	[38]
17	Life cycle assessment of biodiesel from soybean, Jatropha and microalgae in China conditions	2011	[46]
18	A review on prospect of *Jatropha curcas* for biodiesel in Indonesia	2011	[33]
19	Applications of biotechnology and biochemical engineering for the improvement of Jatropha and Biodiesel: a review	2011	[42]
20	Biodiesel production from *Jatropha curcas* oil	2010	[36]
21	Prospects of biodiesel from Jatropha in India: a review	2010	[46]