

## Jatropha for Sustainable Biofuels Production Potential to Enhance Income of Marginal Farmers of Arid and Semi-Arid Regions in India

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### SUMMARY

This article shows sustainable production potential to enhance income of marginal farmers of arid and semi-arid region in India. In Jatropha cultivation most of the activities like digging of pits, weeding, pruning, harvesting and seed separation are done manually. As we know that the most of the marginal farmer perform all the manual operations done by their self. It means they increase their farm family income by growing Jatropha on their farm. The CBR in Jatropha cultivation is 1:1.78.

### INTRODUCTION

Production and use of bio-diesel are becoming an important concern across different countries of the world including India. A limited stock of fossil fuels, problems of global warming, generation of employment and income opportunities, etc., are a few driving forces for increased use of bio-diesel. Along with higher economic growth and changing living standards of people, the demand for energy is fast increasing in India. Jatropha seed is a good feedstock for the bio-diesel industry and plantation of jatropha is beneficial to poor growers in areas where there are few opportunities for alternative farming strategies and livelihood options.

### Importance of Jatropha:

Jatropha curcas, generated interest as an oil crop for biodiesel production and also medicinal importance when used as lamp oil. Jatropha curcas is a semi-evergreen shrub or small tree, reaching a height of 6 metres (20 feet). It is resistant to a high degree of aridity, allowing it to grow in deserts. It contains phorbol esters, which are considered toxic. Jatropha curcas also contains compounds such as trypsin inhibitors, phytate, saponins and a type of lectin known as curcin. The seeds contain 27–40% oil that can be processed to produce a high-quality biodiesel fuel, usable in a standard diesel engine. The oil has a very purgative property. Fruits are produced in winter, or there may be several crops during the year if soil moisture is good and temperatures are sufficiently high. Most fruit production is concentrated from midsummer to late fall with variations in production peaks where some plants have two or three harvests and some produce continuously through the season. The seeds are mature when the capsule changes from green to yellow. The seeds contain around 20% saturated fatty acids and 80% unsaturated fatty acids, and they yield 25–40% oil by weight. In addition, the seeds contain other chemical compounds, such as saccharose, raffinose, stachyose, glucose, fructose, galactose, and protein. The oil is largely made up of oleic and linoleic acids. Furthermore, the plant also contains curcacin, arachidic, myristic, palmitic, and stearic acids and curcin.

### Propagation:

Propagation through seed (sexual propagation) leads to a lot of genetic variability in terms of growth, biomass, seed yield and oil content. Vegetative propagation has been achieved by stem cuttings, grafting, and budding as well as by air layering techniques. Cuttings should be taken preferably from juvenile plants and treated with 200 micro grams per litre of IBA (rooting hormone) to ensure the highest level of rooting in stem cuttings.

### Cultivation:

Jatropha curcas grows in tropical and subtropical regions. The plant can grow in wastelands and grows on almost any terrain, even on gravelly, sandy and saline soils. The best sowing time for Jatropha is July and seed rate 5-7 kg per hectare. Complete germination is achieved within 9 days. Adding manure during the germination has negative effects during that phase, but is favorable if applied after germination is achieved. It can be propagated by cuttings, which yields faster results than multiplication by seeds. The flowers only develop terminally (at the end of a stem). The plants are self-compatible. Another productivity factor is the ratio between

female and male flowers within an inflorescence more female flowers mean more fruits. *Jatropha curcas* thrives on a mere 250 mm (10 in) of rain a year, and only during its first two years does it need to be watered in the closing days of the dry season. Ploughing and planting are not needed regularly, as this shrub has a life expectancy of approximately forty years. The use of pesticides is not necessary, due to the pesticidal and fungicidal properties of the plant. While *Jatropha curcas* starts yielding from 9–12 months time, the best yields are obtained only after 2–3 years time. The seed production is around 3.5 tons per hectare (seed production ranges from about 0.4 t/ha in the first year to over 5 t/ha after 3 years). The fruits are harvested after change of colour of capsule from yellow to brown and shrinking of fruit capsules for easy dehusking. Threshing can be done by Manual separation either by beating and mechanical separation can be done using decorticator. Seeds can be shade dried and stored in gunny bags at room temperature. Yield in 3<sup>rd</sup> year is 1kg per plant and in 5<sup>th</sup> year 5 kg per plant. Economic life of *Jatropha* is around 40 year.

### Processing:

Seed extraction and processing generally needs specialized facilities. Oil content varies from 28% to 30% , one hectare of plantation will give 400 to 600 litres of oil if the soil is average. *Jatropha* oil is not suitable for human consumption, as it induces strong vomiting and diarrhea. Biofuel

### Biofuel:

When *jatropha* seeds are crushed, the resulting *jatropha* oil can be processed to produce a high-quality biofuel or biodiesel that can be used in a standard diesel car or further processed into jet fuel, while the residue (press cake) can also be used as biomass feedstock to power electricity plants, or used as fertilizer (it contains nitrogen, phosphorus and potassium). The cake can also be used as feed in digesters and gasifiers to produce biogas. There are several forms of biofuel, often manufactured using sedimentation, centrifugation, and filtration. The fats and oils are turned into esters while separating the glycerin. At the end of the process, the glycerin settles and the biofuel floats. The process through which the glycerin is separated from the biodiesel is known as transesterification. Glycerin is another by-product from *Jatropha* oil processing that can add value to the crop. Aviation fuels may be more widely replaced by biofuels such as *jatropha* oil than fuels for other forms of transportation.

### Economics of *Jatropha* cultivation:

1 <sup>st</sup> year cost for 1 ha. <i>Jatropha</i> plantation ( 1600 plant/ha)		
S.N.	Particulars	Cost (in Rs.)
1	Site preparation	6000
2	Digging of pits	8000
3	Manure and fertilizer	14000
4	Planting material	40000
5	Planting	14000
6	Irrigation	14000
7	Weeding	14000
Total Cost for 1 st year		110000
2 <sup>nd</sup> year cost for 1 ha. <i>Jatropha</i> plantation ( 1600 plant/ha)		
S.N.	Particulars	Cost (in Rs.)
1	Irrigation	55000
2	Weeding	
3	Pruning	
3 <sup>rd</sup> year cost for 1 ha. <i>Jatropha</i> plantation ( 1600 plant/ha)		
S.N.	Particulars	Cost (in Rs.)
1	Irrigation	65000
2	Weeding	
3	Pruning	
4	Harveting	
4 <sup>th</sup> year cost for 1 ha. <i>Jatropha</i> plantation ( 1600 plant/ha) (harvest increases that's why cost also increases)		

S.N.	Particulars	Cost (in Rs.)
1	Irrigation	75000
2	Weeding	
3	Pruning	
4	Harveting	
5 <sup>th</sup> year cost for 1 ha. Jatropha plantation ( 1600 plant/ha) onward		
S.N.	Particulars	Cost (in Rs.)
1	Irrigation	90000
2	Weeding	
3	Pruning	
4	Harveting	
<b>Returns</b>		
S.N.	Yield	Returns (in Rs.)
1	3 <sup>rd</sup> year yield 1600kg @ 20 Rs/kg	32000
2	4 <sup>th</sup> year yield 3200kg @ 20 Rs/kg	64000
3	5 <sup>th</sup> year yield 8000kg @ 20 Rs/kg	160000
<b>Net returns</b>		
Net return after 5 year onwards		160000-90000= 70000
<b>Cost Benefit Ratio</b>		
CB Ratio		1:1.78

## CONCLUSION

The study has revealed that Jatropha plantation in arid and semi-arid regions in India is economically viable, though not highly profitable at the present. Since the cost needed for plantation is relatively lower for Jatropha than other plantation alternatives in the region, resource-poor growers may look for investment in Jatropha plantation. The major cost component of Jatropha plantation is labour cost, which is incurred on operation and maintenance, digging of pits, weeding, pruning, harvesting and seed separation activities. The cultivation would become attractive for the growers, if they get adequate financial support for operating and maintaining their plantation sites.

## REFERNECES

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