

Here is an Eco-friendly alternate to me – Fossil Fuels.

Introduction to Jatropha:

Biodiesel is an environmental friendly alternative to the fossil fuel and hold immense potential to mitigate the future energy needs of the country and also to impart economic prosperity in the poor and backward areas of the country. Jatropha (biodiesel Plant) cultivation is economic, convenient and could provide a steady alternative source of income to the farmers.

Jatropha plantation has been identified as a most suitable option for the production of bio-fuels utilizing non-edible sources. Jatropha is a wild plant and is well adapted for growth in harsh conditions climatic conditions. It does not require any particular soil type for growth and can flourish on almost any soil composition

The plant is extremely drought resistance as its water requirement is extremely low. It can be easily propagated and grows rapidly. Sufficient amount of waste land is available in the State which could be utilized for jatropha cultivation.

Steps for encouraging Jatropha cultivation:

The FICCI Core Group on Biofuels has made wide-ranging recommendations to boost large-scale corporate Jatropha plantations for the production of bio diesel and reduce India's massive crude import bill.

The FICCI Core Group, Chairman, FICCI Agriculture Committee, in its presentation to the Ministry of Agriculture has suggested that, amongst other steps, the government should grant a 10-year exemption of excise and customs duties as well as all Central and State levies on bio diesel or Jatropha oil. FDI for Jatropha cultivation and production of bio diesel needs encouragement. FICCI further suggests dovetailing of Jatropha cultivation with National Rural Employment Guarantee (NREG) Scheme.

Indian economy is severely plagued with oil imports. India is not self-sufficient in petroleum and has to import about two thirds of its requirement. India produced 32 million tons of oil and imported nearly 99 million tons, which is nearly 80 % of its requirement. The import cost during 2006 was around Rs.171702 crore. Hence, the oil import bill has serious consequences on the Indian economy. India's known crude oil reserve is estimated to last only for the next two decades approximately. India has to strive to achieve self-sufficiency in fuel availability. Substitution of bio-fuel for oil will therefore have a positive effect on reducing imports. Displacing oil with bio-fuel apart from having direct consequences upon national economy would have enormous effect on the environment. They would play a crucial role in mitigating the pollution to a greater extent.

The FICCI Core Group feels that if the Plantations are brought under the reforestation projects under the Clean Development Mechanisms there is potential for farmers and low-income communities to gain early returns from the carbon mitigation in tree biomass. The income from carbon trading would amount to an average of Rs.2800/ha from the fifth year of planting. The income from trading the carbon credits as well from the Jatropha seeds makes this highly remunerative for the wasteland tracks in India.

The other major recommendations made by FICCI Core Group are:

- Single window clearance for setting up plants.
- The upper ceiling of subsidy by National Oilseeds & Vegetable Oils Development Board (NOVOD) , which is Rs.6.50 lakh should be removed to encourage farmers and corporate
- Simplify procedures for availing credit/loans
- National Bio Fuel Policy has to be approved by Government of India.
- At present the Government of India has entrusted funds for the Renewable Energy Sector with the Ministry of Non-Conventional Energy. Bio fuels must come under purview of Ministry of Agriculture and National Oil Seeds and Vegetable Oils Development Board, Gurgaon
- 100 DAYS OF Jatropha labor would provide jobs to a large number of rural families and women laborers could easily be drawn for nursery work
- There should be a Government mandated (or strongly encouraged and supported) blending of Bio Diesel into the regular diesel fuel as to guarantee a floor level of consumption.
- The wastelands can be allotted by Letter of Intent to plant the trees along with Lease Agreement. It should be leased for a crop period of 35-40 years.
- Land Lease charges should start from fourth year, when the income generation starts. Land Lease charges should not be more than 5% of the income or maximum of Rs.1500 per hectare, which should be uniform for all the states.
- Transparency in allocation of wastelands in a time-bound programme from date of application. If land not used for Jatropha plantation within 18 months after allocation, lease to be cancelled.
- Jatropha should be brought under the purview of Comprehensive Wasteland Development Programme.
- Elite varieties are to be identified which can Provide high yield and high oil content
- Plantation techniques needs to be standardized
- Protocol should be developed for Tissue Culture from high yielding Jatropha.
- Provide capital subsidies to processing industries along with subsidized interest rates for setting up bio fuel plants
- Encourage R&D for development of efficient bio fuels and R&D for automobile engines compatible for using bio fuels
- A special body should be created for carbon trading of Jatropha to help the farmers

- Permit SSI to get licenses for manufacture / production of bio diesel and sale
- Separate Board to monitor, certify and sale of bio diesel production

Jatropha's ability to grow on marginal, waste or arid land and without displacing food crops is perhaps most important to the developing world, particularly as they face the effects of climate change. This aspect of Jatropha has made it particularly attractive to the Indian Government. Given India's booming economy, its transport sector will consume even-higher amounts of fuel over the coming years. Indeed, demand for diesel fuel is expected to grow from current levels of 44 million tonnes to 67 million by 2010. Aware of these predictions, India was to blend 5% of diesel with biodiesel by 2005-6; however, due to lack of enabling environment, this could not happen. Huge amount of money is being spent on exploring for new reserves without any certainty, while on other hand biofuels production is a certainty.

India has about 24 million hectares of land that is classified as cultivable wastelands. Jatropha curcas thrives on any type of soil, can endure long periods of droughts and needs minimal inputs or management. It has no problems due to insects, pests or browsing by cattle and sheep. Propagation is easy and the yield starts from 3rd year and continues till 30 -35 years. The yields expected from Jatropha plantations would be close to 2.5t/ha. Oil content varies from 28% to 38% in Jatropha depending upon the species. At a price of Rs.5 /kg of seed, even 5.0 ton of seeds/ha represents Rs.25, 000 incomes for the communities

Investment on Jatropha:

The jatropha plant bears fruits from the 2nd year after its plantation and the economic yield stabilizes from the 4th or 5th year onwards. The plant may live for more than 50 years with an average effective yielding time of 50 years. The economic yield can be considered as 0.75-2.00kg/plant and 4.00-6.00 tonnes per hectare per year depending on the agro-climatic zone and agricultural practices. The cost of plantation has been estimated as Rs.20, 000 a hectare, inclusive of plant Material, maintenance for one year, training, overheads and the like. A selling price of jatropha seeds at Rs.12 a kg would be an economically attractive proposition for farmers. Oil from jatropha seeds (oil content: 35 per cent on average) can be extracted by using a screw press for further processing into biodiesel by the trans-esterification route. Trans-esterification is the process of converting the raw vegetable oil into biodiesel. The process involves displacement of alcohol from an ester by another alcohol (Methanol is used commonly).

Unit cost:

The cost of cultivation of *Jatropha curcas* in one hectare at an area of 3m X 2m i.e., 1666 plants per ha has been worked out at Rs.25, 826/- per ha. (Un-irrigated condition). The details of various items of expenditure are viz. land preparation, digging of pits, plant and material, manure and fertilizer, inter culture, watering and plant protection etc. The unit cost break up of *Jatropha curcas* is as follows:

Basis for Economics:

ESPACEMENT:	3 M x 2 M
AVG. WAGE RATE:	Rs.50/MD
NO.OF TREES/HA.:	1666
CASUALTY REPLACEMENT:	10 %
SURVIVAL/HA.:	1500 Nos.

SL. No	Particulars of Works	Unit	COST (Rs.) PER YEAR			Total (INR)
			1	2	3	
1	Site preparation	10 MD	500			500
2	Initial ploughing for 6 Hrs	100/Hr	600			600
3	Intercropping	Rs.1000	1000			1000
4	Alignment, & staking	5 MD	250			250
5	Digging of pits (45 cm ³)& refilling @50 pits/MD & 150 pits/MD	44 / 14 MD	2200	700		2900
6	Cost of FYM @2 Kg/pit	Rs.150/ton.	500			500
7	Cost of fertilizer @250gm/plant	Rs.2000	2000	2000	2000	6000
8	Cost of plants including transport (1666, 166 nos.)	Re.3 per	4998	498		5496
		plant				
9	Planting & replanting @100 plants per MD					
		16 & 5MD	800	250		1050
10	Weeding, soil working, application of fertilizer etc.(3,2,1)	10 MD per	1500	1000	500	3000
		working				
11	Plant protection measures.	LS	100	100	100	300
12	Pruning	20 MD	1000	1000	1000	3000
13	SUB TOTAL	INR.	15448	5548	3600	24596
14	Contingencies	5%	772	277	180	1230
15	Grand Total	INR	16220	5825	3780	25826

Yield and Income per Hectare of Jatropha Cultivation on Wastelands

YEAR	SEED PER TREE(Kg.)	NO.OF TREES	QNTY.OF SEED(KG)	COST PER KG.	TOTAL INCOME (RS)
3	0.50	1500	750	5	3750
4	0.50	1500	750	5	3750
5	1.00	1500	1500	5	7500
6	1.50	1500	2250	5	11250
7	2.00	1500	3000	5	15000
8	2.50	1500	3750	5	18750

Economics of Jatropha cultivation in one Hectare of wasteland

Years	1	2	3	4	5	6	7	8
Cost	16220	5825	3780					
Benefit			3750	3750	7500	11250	15000	18750
Net benefit	-16220	-5825	-30	3750	7500	11250	15000	18750

PWC@ 15% 20994.30

PWB@ 15% 24970.74

BCR 1.19

IRR **19.41%**.

Return on investment

For an optimal capacity of 10,000 TPA of biodiesel, the capital cost for oil extraction and trans-esterification would be Rs.20, 000/tonne capacity. The return on investment (ROI) has been arrived at 15 per cent pre-tax on the capital cost. The efficient storage of biodiesel resources can provide energy security to the Country. Biodiesel can safely be stored for up to 6 months. The existing storage facilities and infrastructure for petrol and diesel can be used for the biodiesel with minor alterations.

12 million jobs:

India has vast stretches of degraded land, mostly in areas with adverse agro-climatic conditions, where species of jatropha can be grown easily. Considering 10 million plantations on both

sides along the railway tracks, 1, 26,000 hectares can be cultivated with jatropha. Use of 11 million hectares of wasteland for jatropha cultivation can lead to generation of a minimum of 12 million jobs. Production of bio-fuel from plant materials is a major step toward harnessing one of the world's most-prevalent, yet least-utilized renewable energy resources. India, with its huge waste/non-fertile lands, has taken a well-noted lead in jatropha cultivation and commercial production is what the industries have to focus on for sustainable development.

Intercropping:

Intercropping of jatropha with lemon grass, turmeric, ashwagandha and the like has been found to be an economically viable option when compared with mono-cropping. Since jatropha is not suitable for forage, fence farming is also an attractive option. Plantation of saplings from the seeds rather than vegetative propagation is a better option for the dry areas.

The plantation of saplings (4 months old) should be carried out before the rains. As the growth and canopy coverage are more in fertile soil, the plants occupy more area when compared with dry land cultivation. While the plantation pitch for jatropha could be 1.5 x 1.5m in lighter/dry lands, a spacing of 2.0 x 2.0m would be required in fertile soil resulting in 2,500 plants/hectare. For intercropping, a spacing of 3m should be maintained between the rows for inter-cultivation and ploughing required for vegetables and flowers. For better growth, the plants require irrigation for the first two years. The plants require pruning after they grow over 1.0 m in height.

Cultivation practices:

It can be easily propagated on massive scale by direct seeding as well as planting stem cuttings. Hot and humid weather is preferred for good germination of seed. Plants bear fruits in the beginning of winter. Approximately 5-6 kg of seed is adequate to raise one hectare of plantation. The spacing maintained is about 2m x 2m and for high density planting 2m x 1m Distance can be recommended. Seeds or cuttings can be directly planted in the main field. Some times the seedlings are grown in poly bags and then transplanted in the main field. The land should be ploughed once or twice depending upon the nature of soil. In direct planting system the seed/cuttings should be planted in the main field with onset of monsoon at a spacing indicated above. Apart from organic manure, mixtures, fertilizers containing NPK should be applied near the planting hole.

To keep the land free from weeds in the initial stage, 3-4 hand weeding are necessary; it does not require supplementary irrigation. However, the approximate yield of 1200 kg seed per hectare may be obtained from irrigated plantations in comparison to 750 kg seed (per hectare) from rain fed plantations. This is expected from 3rd year onwards. The economic life of the plant is about 35-40 years. Jatropha oil is extracted by hydraulic press method after grinding and steaming of the seed.

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Yield and Economics:

The plant starts giving yield from the third year onwards and the benefits increase over the years and stabilizes in the 8th year. In the financial analysis with the above parameters of the investment cost & yields, the BCR & IRR works out to 1.19 & 19.41% respectively.