The Jatropha crush

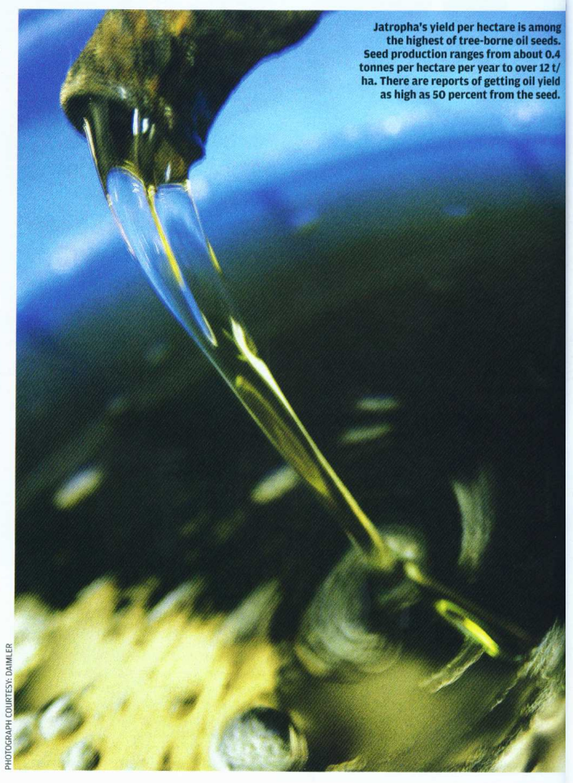
As a source of biofuel, Jatropha may be India's best bet but will it significantly reduce diesel imports? **Rachit Vats** gets into the seed of the issue.

Most inventors are farsighted. Men like Rudolf Diesel. The renowned maker of the engine that bears his name had said over a 100 years ago: "The use of vegetable oils for engine fuels may seem insignificant today. But such oils may become in course of time as important as petroleum and the coal tar products of the present time."

In 1892 Rudolf Diesel designed his prototype engine and ran it on peanut oil. Later usage of fossil oil — petrol and diesel — became widespread and soon controlled the world economy. The recent spurt in global crude oil prices shook everyone and analysts had predicted that the $200 per barrel price day was not far. That was in June and since then prices have somewhat cooled off. Demand for fossil fuels has always been high and countries like India depend on oil imports to satiate domestic demand. According to the Petroleum Ministry, since 2003 India's net crude oil imports have gone up from 90,434 tonnes to 10,858 tonnes per year.

The ever-increasing use of non-renewable fossil fuels to run vehicle populations the world over is among the reasons behind rising air pollution, and greenhouse gases. The rise in oil prices, the resultant inflation and economic uncertainties are forcing countries and manufacturers to actively check out the potential of biofuels. No wonder then, Diesel's 19th century prediction seems to be coming true in the 21st century.

Biofuel is much like petrol or diesel but it is derived from organic sources, such as waste vegetable oil (green diesel) or sugarcane (bioethanol). In India and a few other countries, Jatropha is making news. This hardy crop, whose seeds have up to 40 percent oil content, is seen to be an ideal biodiesel-generator as it can be grown in poor soil, is drought and pest-resilient and yields seeds within the first year after plantation.



Jatropha's yield per hectare is among the highest of tree-borne oil seeds. Seed production ranges from about 0.4 tonnes per hectare per year to over 12 t/ha. There are reports of getting oil yield as high as 50 percent from the seed.

PHOTOGRAPH COURTESY: DAIMLER

From the vehicle manufacturers' viewpoint, Jatropha could be the silver bullet to the fuel crisis.

Biofuel: a cause of concern?

The general global consensus for biofuel is that as an experiment it has gone awry and is being held responsible for pushing up the prices of food grain by as much as 75 percent particularly in countries like the USA which in the recent past has seen large tracts of land, originally meant for growing cash crops, now dedicated to corn-based production. India, however, has been on a safe path so far. Despite its long-pending biofuel policy, the country has so far avoided the path walked by the US.

However, India, despite not using any edible oil plants for churning out biofuel, may still get caught in the viscous food price cycle. Jatropha, which at present is being recommended by the Ministry of New and Non Renewable Energy, may encourage the use of agricultural land to cultivate fuel crops thus increasing the risk of food crops being grown solely to produce fuel in India. In fact, there have been reports from a few States where agricultural crops have been destroyed to plant Jatropha.

So, only preventing the cultivation of fuel crops on agricultural land may not be enough to secure food production and prices. There is always a danger that farmers could switch to cultivating fuel crops on agricultural land, especially since growing fuel crops may soon be more profitable than growing food! This could further threaten India's relatively poor productivity levels in agriculture.

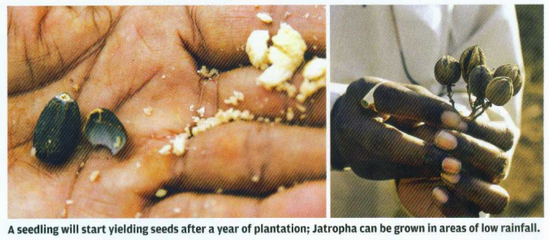
The Jatropha card

From the vehicle manufacturers' point of view, Jatropha could be the silver bullet to the conventional fuel crisis. Driven by soaring crude prices, automakers such as Daimler, General Motors and Mahindra & Mahindra (M&M) have already betted big on Jatropha. Daimler and GM have been testing their vehicles on this alternate fuel and also fostering Jatropha cultivation for wide-scale experiments in India. In fact, Daimler has been actively working on Jatropha in India since the past four years. The Gujarat-based Central Salt and Marine Chemicals Research Institute (CSMCRI) is supporting these companies to recognise the virtues of Jatropha as an alternate fuel in their futuristic engines.

Daimler's biodiesel project was launched in August 2003 in collaboration with the Council for Industrial and Scientific Research (CSIR), India and Hohenheim University, Germany. The project was aimed at demonstrating a new model for the production of environment-friendly biodiesel in India and using it as a fuel for the modern automobile. Two Mercedes-Benz vehicles — a C-class saloon and a Viano van — were tested on 100 percent biodiesel on a drive from Pune to Leh. No major changes were made to the engine management system and only the fuel pipe lines and fuel tank were reinforced to account for the more aggressive nature of biodiesel.

According to Manas Dewan, deputy general manager - Corporate Communications, Daimler (India), "The road tests with biodiesel cars are an ongoing process. Till now, the cars have clocked approximately 110,000km cumulative. The fuel consumption as observed by us is comparable to cars running on fossil diesel and our vehicles showed no particular deviations as far as performance is considered. The particulate emissions from the vehicle showed a drastic reduction to almost one-third as that of normal diesel. The nation-wide road trials in 2004 and successful cold weather-high altitude road tests in Leh (2005) helped generate further findings. We are now evaluating further future steps towards proving this concept at an agronomic and production level."

GM India's biodiesel project is spearheaded by its engineering department, which works in conjunction with GM's Detroit-based research and development (R&D) team. Spread over three phases, GMI has already completed the first



A seedling will start yielding seeds after a year of plantation; Jatropha can be grown in areas of low rainfall.

Jatropha is a hardy crop that is seen to be an ideal biodiesel-generator as it can be grown in poor soil, and is also drought and pest-resilient.

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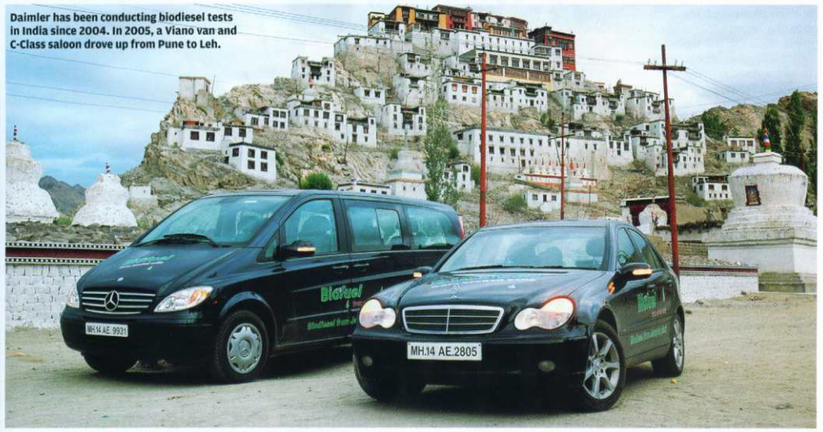


Daimler has been conducting biodiesel tests in India since 2004. In 2005, a Viano van and C-Class saloon drove up from Pune to Leh.

phase of its Jatropha biodiesel project. In fact its second manufacturing plant at Talegaon, which commenced operations earlier this month, also has a small plantation of Jatropha. This is in addition to the 80 hectares of land that the company is planning to cultivate on the wasteland in Gujarat and GMI is in the process of entering into an agreement with CSMCRI.

Says P Balendran, vice-president, corporate affairs, GM India: "In the first phase we put the various GM models on the biodiesel test and are quite satisfied with the results. In the second phase, which is nearing completion, we fiddled a bit more with the Jatropha cultivation. The project will be taken to the next level in the next phase." Balendran refused to detail the models which are being tested for the biodiesel compatibility.

M&M too has worked on a similar project.

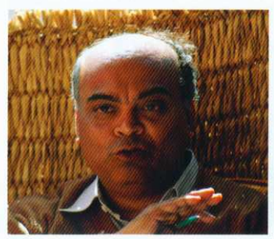
BIOFUEL YIELDS

Biodiesel crop	Litres of oil per hectare
Oil palm	2,400
Jatropha	1,300
Rapeseed	1,100
Sunflower	690
Soya bean	400

Dr Arun Jaura, Group Chief Technology Officer & Head of Office of Innovation and Global Advanced Technologies, M&M, says: "We have always been committed to fuel conservation. In fact, all our passenger vehicles have surpassed the B5 (five percent biodiesel), B10, and B20 norms."

Other than these vehicle-makers, even corporates such as Mukesh Ambani-led Reliance Industries have jumped into the cultivation of Jatropha-based biodiesel. Reliance Life Sciences (RLS) is at present concentrating on testing biodiesel produced from non-edible sources in all types of engines, ranging from stationary single-cylinder agricultural pump engines, tractor engines to four-stroke multi-cylinder truck engines. The company is conducting a study in association with the Indian Institute of Technology –Chennai before taking biodiesel to

Reliance Life Sciences' K V Subramaniam: "Our biofuel initiative, which includes Jatropha, stays away from using fertile land used for food crops."



CSMCRI's Dr Pushpito Ghosh: "Jatropha biofuel has the potential to reduce outflow of foreign exchange and could very well get exported too."

M&M's Dr Arun Jaura: "We are committed to fuel conservation and all of our passenger vehicles have surpassed the B5, B10, and B20 norms."

General Motors' experiment with the Jatropha-based biodiesel in India has entered its third phase.

the market.

Says KV Subramaniam, president and CEO, RLS, "The Reliance Life Sciences biofuel initiative is based on using non-edible seed oils and targets using cultivable waste land. It stays away from using fertile land used for food crops. In addition, the initiative involves promoting Jatropha cultivation with several inter crops like mango, corn, soyabean, and vegetables. This means a reversal of the food versus fuel debate that is currently taking place in the western world."

RLS has established alliances with farmers in Andhra Pradesh, Maharashtra, Madhya Pradesh and Gujarat to build clusters of 100,000 acres feeding into 100,000-tonne biofuel extraction plants. It has signed agreements with 1,200 farmers with one- and two-year-old Jatropha plantations on 2,200 acres of wasteland in Nizamabad, Andhra Pradesh.

Also recently, Aditya Aromedic and Bio Energy, an Ahmedabad-based company has recently started commercial production of Jatropha biodiesel. The company sells the bio-diesel cheaper than the fossil diesel sold by oil marketing companies. Registered in 2005, Aditya Aromedic started commercial production of bio-diesel from Jatropha three months ago. Meanwhile, sensing a business opportunity, other companies have entered the fray. They include Bharat Petroleum, Nandan Biomatrix, Indian Oil, Godrej Agrovet, Tata Motors and construction company Shapoorji Pallonji.

In 2003, the Indian government had announced that it planned to increase the share of indigenously-produced biodiesel to 20 percent by 2011-12. Much before this announcement, a few Indian cities started experimenting with Jatropha as a source of biodiesel. Nashik in Maharashtra is one such example where since 1992 about 4,000 hectares of land is being used to develop Jatropha plantations.

Similarly, other States such as Andhra Pradesh, Chhattisgarh and Tamil Nadu have already taken up large-scale plantation of the Jatropha seeds as it converts vegetable oil to diesel power. Jatropha oilseeds are worth a serious thought since they grow easily on waste land. Seed yields of 2-5 tonnes per hectare have been routinely achieved with an oil content of 30-40 percent.

Drive slow, crop-switching ahead

So, will the global food versus fuel debate be rendered irrelevant by India's Jatropha biodiesel business model? Will the Jatropha cultivation lead to land grab? Dr Pushpito Ghosh, a leading Jartopha researcher and director of CSMCRI, says, "It is precisely to avoid the dilemma of food versus fuel that we focused on Jatropha as a non-edible oil seed crop to be cultivated on marginal lands. However, one cannot be sure that merely because it is being cultivated here that it will be used here. All of it could well get exported if this leads to higher returns."

Ghosh adds, "The best way India can avoid a situation like that in the US is by ensuring that no subsidy of any kind is given for Jatropha cultivated on any land other than certified wasteland. Similarly, no subsidy should be given on Jatropha seed which is not obtained from wasteland. Of course, how one will police these is another matter."

Ghosh believes automotive companies are showing interest in Jatropha biofuel because of its exceptional quality of biodiesel and also to avoid the dilemma of food versus fuel. Though there is no chance that Jatropha-derivative fuel will meet a majority of India's fuel needs (it may meet only three percent of India's energy needs at present), there is no single solution and one needs a basket of options.

As an alternate fuel bio-diesel in India, Jatropha makes fiscal sense. Even if it does not come anywhere near replacing the entire fuel demand of the country, it nevertheless has the potential to reduce the outflow of foreign exchange significantly. Jatropha as a choice fits the country's need as it achieves the end without putting too much pressure on other edible crops grown in India. ■

30 SECONDS ON... THE BENEFITS OF JATROPHA

According to the Petroleum Conservation Research Association (PCRA), a Jatropha seedling will start yielding seeds after a year of its plantation. It is planted 2m x 2m and 2,500 plants can be grown in one hectare. Twenty percent of the plants transferred from a nursery would need to be replaced taking into account the usual rate of mortality of plantations. Jatropha can survive with minimum inputs and propagates easily. Flowering occurs during the wet season and two flowering peaks are generally seen. The seeds, which have an oil content of 37 percent, mature about three months after flowering.

One expeller is required for a minimum 100 hectares of Jatropha and one esterification plant is required for 1,000 hectares of Jatropha.

Jatropha oil can be combusted as fuel without being refined. It burns with clear smoke-free flame and has been tested successfully as fuel for a simple diesel engine. Cost of biodiesel varies between Rs 14.98 to Rs 16.59 per litre. Oil extraction is almost 91 percent. 1.05kg of oil is required to produce a litre of biodiesel.

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