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PROMISING CROP
**Jatropha Plant Gains Steam
 In Global Race for Biofuels**
**Hardy Shrub Is Tapped
 For Energy-Rich Seeds;
 Indian Farmers' Big Bet**

 By **PATRICK BARTA**
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HIRIYUR, India -- Until recently, B.K. Nagendrappa didn't care much at all about jatropha, an ugly wild green shrub that thrives in India. Now, the coconut grower hopes to plant as many as 12 acres of the stuff on his land near Bangalore.

V. Venkateswarao is also raising the plants -- on a dried-up stretch of dirt east of Hyderabad. So too is O.P. Singh, a horticulturist for India's Ministry of Railways, in a quiet garden by an old airport in New Delhi.

"This plant will save humanity, I tell you," Mr. Singh proclaims, as he points to 4-foot-tall jatropha shrubs nearby. Someday, "every house will have jatropha!"

With oil trading at roughly \$70 a barrel, this lowly forest plant is suddenly an unlikely star on the world's alternative-energy stage.


The seeds from jatropha's golf-ball-size fruit contain a yellowish liquid similar to palm oil that can be made into biodiesel -- an increasingly important renewable fuel used in Europe, the U.S. and elsewhere.

But unlike other biodiesel crops, jatropha can be grown almost anywhere -- including deserts, trash dumps, and rock piles. It doesn't need much water or fertilizer, and it isn't edible. That means environmentalists and policy makers don't have to worry about whether jatropha diverts resources away from crops that could be used to feed people.

These qualities are crucial at a time of intensifying concern over the environmental and social consequences of a global alternative-energy boom. It takes huge quantities of land, water and chemicals to grow crops to make ethanol and biodiesel. And as more governments set targets for their consumption, fears are rising that the world won't be able to meet the demand without significant environmental damage.

Goldman Sachs recently cited jatropha as one of the

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best candidates for future biodiesel production. A Bear Stearns analysis last year found that U.S. farmers only have the capacity to replace about 7% of the country's gasoline with corn-based ethanol, despite a new federal renewable-fuels target of 15% by 2017. To reach that goal, the U.S. would likely have to find a lot more land.

Poverty remains an entrenched problem in India. Some rural development experts fear that small Indian farmers could wind up serving as guinea pigs for a failed jatropha industry.

India, by contrast, has millions of acres of wasteland that isn't fully utilized due to low water tables and infertile soil. Jatropha advocates figure the crop can cover much of that area without causing environmental distress.

In late June, oil giant **BP PLC** said it will invest \$90 million in a joint venture with U.K.-based **D1 Oils PLC**, a biofuels start-up that's developing jatropha in India and elsewhere.

Another company, Australia-based Mission Biofuels Ltd., has raised more than \$80 million from investors and has representatives fanning out across the Indian subcontinent to sign up growers. It has roughly 66,000 acres under cultivation already and expects to hit 250,000 by 2010.

SEEDS OF HOPE

- **Plant Matter:** Investors and farmers in India are looking to the wild jatropha plant as a potential source of biofuel.
- **Strong Kick:** Jatropha yields energy more efficiently than corn and other alternative-energy feedstocks, and thrives in harsh conditions.
- **Future Yields:** The plants take several years to produce large amounts of oil, and the crop's market potential is still unknown.

Other countries -- including the U.S. -- may have similar bounties of untapped land for jatropha, and farmers are already rushing to plant the crop in Thailand, the Philippines, Swaziland and even Saudi Arabia.

The enthusiasm for jatropha and its ilk highlights how quickly investors are shifting gears as the shortcomings of other renewable fuels become more apparent. It also illustrates the risks of newer

approaches, since it's still far from clear whether jatropha and its peers are economically viable on a large scale.

By some estimates, the per-barrel cost to produce biofuel using jatropha -- about \$43 -- is about half that of corn and roughly one-third that of rapeseed, two other leading materials for alternative energy. At those prices, jatropha biodiesel would be competitive with fuel made from crude oil without significant government subsidies.

Used as a Hedge

But such calculations are based on limited experience with the crop. Agronomists hardly studied it in the past because it was considered to be mostly worthless. Until recently, jatropha was best-known in India and elsewhere as a hedge to keep wild animals from wandering onto farms.

Even some of jatropha's biggest advocates concede the plant's oil output is unpredictable and often lower than expected. Although it can grow without water, it tends to do much better when water is added, raising its cost of production and mitigating some of the perceived benefits.

Some farmers have already reported financial losses from jatropha plantations after their crops yielded less oil than expected or buyers failed to pay sufficient prices. In a worst-case scenario, some rural-development experts fear, small Indian farmers could wind up serving as guinea pigs for an untested industry, leaving them in debt if the boom fizzles.

Power Prices

Estimated cost per barrel of fuel produced by selected biofuel

"Everybody is so excited, but is [jatropha] really happening? I'm not so sure," says Amit Sachdev, a New Delhi area-based representative for the U.S. Grains

Council, which represents the interests of one of jatropha's competitors: American corn.

More research is needed "instead of hype," adds Manfred Zeller, a rural-development expert at the University of Hohenheim in Stuttgart, Germany. Any ecological downsides -- such as the draining of water resources to accelerate plant growth -- are thus far unknown.

Land Shortage

Still, jatropha's allure is undeniable. Planting more palm oil, corn or other crops to make ethanol or biodiesel isn't really an option due to land shortages and other constraints. Water tables are falling across India, and production of some key commodities like rice has already flattened out in recent years. The country could have trouble meeting its own food needs even without a biofuel boom.

First cultivated in South America, jatropha was brought to India long ago by Portuguese traders. Villagers used it as a hedge crop, and some extracted oil and latex from the plants to make soap or fuel for lamps. Many Indians recall using the latex from jatropha to blow bubbles when they were children.

The Indian government started getting excited about jatropha a decade ago. Officials were already worried about India's energy security and asked a private, nonprofit research outfit called The Energy and Resources Institute to look into jatropha's potential as a fuel source.

Researchers at TERI studied the plant in a lab on the sixth floor of their New Delhi offices, and were encouraged. "You can put it in any kind of soil, and it will grow," says P.P. Bhojvaid, a senior fellow at TERI. If cared for properly, the plants can live up to 45 years.

As TERI made progress, other Indian leaders jumped on the bandwagon. Former President A.P.J. Abdul Kalam planted jatropha in his peacock-filled gardens in New Delhi and touted the plant in speeches to the nation. The state railway ministry began using jatropha last year to fuel some of its locomotives and planted 7.5 million jatropha plants along its tracks. The government ordered state-run oil companies to buy jatropha-made biodiesel at a minimum price of about 26 rupees a liter, or about \$2.40 a gallon. Several of India's local governments began handing out free saplings.

All this set the stage for companies like Australia's Mission to move in. Founded by a Malaysian-born businessman in 2005, it aimed to capitalize on the new biofuel boom by building a palm-oil biodiesel refinery on the coast of Malaysia.

But Mission officials wanted a backup raw material in case palm-oil prices shot up, as they have since 2005. After some research, they settled on jatropha, in part because it's inedible and therefore unaffected by demand from food buyers.

The use of food crops to make fuel "will only push up the price of food, and food has to win -- otherwise, the world will go into starvation," says Nathan Mahalingam, Mission's managing director. "We want to stay clear of that, and that's why we're moving into jatropha."

Mr. Mahalingam estimates that each acre of jatropha planted will produce about one ton of oil,



with yields hopefully improving over time.

To seed a network of growers, the company recruited people like K. Chalapathy Reddy, a 30-year-old plant breeder. Now, as a Mission senior scientist, he spends much of his time touring the Indian countryside, helping convince farmers to take up the crop and looking for ways to boost their yields. His mobile phone rings constantly with calls from farmers seeking advice on how to prune their plants or when to apply water.

In towns such as Hiriyur, about a three hours' drive across the dusty flat lands outside Bangalore, Mr. Reddy relies on local agents who talk up jatropha at agricultural fairs and town meetings. They hand out Mission brochures that feature drawings of a car pulling up to a smiling tree labeled "biodiesel."

Farmers' Contracts

Typically, Mission's agents sign up farmers to contracts that commit them to sell all their jatropha to the company for 30 years. It charges farmers three rupees per plant. But Mission says it often forgoes payment until after the plants start producing significant quantities of oil, a process that usually takes two to three years.

Mr. Reddy acknowledges jatropha promoters have come and gone, and that sometimes farmers are skeptical. "There's nothing like hide-and-seek here, we're not fooling the farmers," Mr. Reddy says. "We get nothing unless the crop comes in."

Among Mission's growers is 42-year-old K. Nagaraj, who says he used to grow groundnut on a small plot of land near Hiriyur. But the soil conditions weren't ideal, and after water and fertilizer expenses, it wasn't possible to make much of a profit.



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Jatropha promoters, including scientist K. Chalapathy Reddy (far right), with plant.

He says Mission offered a guaranteed price of five rupees per kilogram for his oil-bearing jatropha seed, which he reckons should translate into a profit of about 10,000 rupees, or about \$250, an acre.

"Initially, I was a bit skeptical," he says of jatropha. "But when we got more information, and the president was telling people about it, we gained confidence."

Other farmers in the area are also giving jatropha a go - without even knowing whom they'll sell it to.

One of Mr. Nagaraj's neighbors, a former politician named H. Ramaiah, says he made his living in recent years from coconuts. But his trees are dying from insufficient water, so he now hopes to have better luck with jatropha. On a recent visit, his jatropha plants were hardly distinguishable from other weeds on the property.

Jatropha "takes very little water, so maybe it will work," Mr. Ramaiah said hopefully. When asked who might buy his future oil harvest, he was uncertain. "Whoever is giving the most profit," he said.

--Tariq Engineer in Mumbai and Binny Sabharwal in New Delhi contributed to this article.

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