

Flowers in the desert

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Vallhaba Bhai points to the parched steppe around his village Chorvadla in India's Gujarat state. "There's hardly anything we can do with this wasteland." A lone emaciated cow lethargically plucks up a few blades of dry grass. But then the headman of the village of 1,200 smiles, saying, "We may be able to use the land in future."

The reason for his optimism is [jatropha](#), a round, green fruit which when dried reminds you of a walnut. It contains three black seeds. These oil-containing kernels could make jatropha the cash crop of Indian farmers. Not only is the drought-resistant wonder plant easy to grow almost anywhere, high-quality biodiesel can also be produced from it.

"Around our village are 500 hectares of wasteland suitable for growing jatropha," says village leader Bhai. The men around him nod. They're sitting on a green sheet, drinking sweet tea or smoking hand-rolled beedies of strong tobacco, smelling of burnt foliage. The men are taking a break from their work on a trial jatropha plantation.

Ten hectares are planted with long rows of mostly small plants. Their green contrasts conspicuously with the parched surroundings. "We're testing under which conditions the jatropha shrub produces the highest yields," explains Jinabhai Sambhubhai Patolia, a scientist at the [Central Salt and Marine Chemicals Research Institute](#) (CSMCRI) in Bhavnagar in Gujarat. The renowned institute is the local partner of a German-Indian development project. Biodiesel from jatropha is to help meet the fuel demand of the billion Indians, cut CO₂ emissions and revitalise degraded land.

The plant is also to become a new source of income for small-scale farmers. Although India's economy is growing by eight per cent a year, one in four Indians still has to get by on less than a dollar a day. Many of these poor live on the land. They include farmers who own five to six hectares. Over-use, erosion and climate change have made a lot of land useless - and jatropha could bring them new opportunity.

No competition to food crops

Partners to the Indian research institute in the jatropha project are the [German Investment and Development Company](#) (DEG), Hohenheim University in Stuttgart and the transnational motor company, [Daimler Chrysler AG](#). Daimler Chrysler has contributed €750,000 and three test vehicles of their Mercedes C-Class. Produced at the Indian plant at Pune, about 100 kilometres north of Mumbai, they've already done 100,000 km on diesel fuel, criss-crossing the entire country. "Even on the highest road in the world, in Leh in the Himalayas, there were no problems," says a happy Manas Dewan of Daimler Chrysler in Pune.

As they toured, the test drivers are likely to have seen many areas that would suit the hardy oil plant. The subcontinent is estimated to have around 170 million hectares (66,000 square miles) of wasteland. "Jatropha could be grown on a good third of that," says Patolia of the CSMCR!. The rest is very hard to develop, he says.

A big jatropha plus is that it doesn't compete with food crops for land because it doesn't need fertile soil to grow. It actually even helps to repair or prevent damage caused by erosion.

The miracle plant is not new, it was just newly rediscovered. "We used to plant the bushes between fields," recalls villager Bhai and squints as a gust of wind drives a dust cloud at us. The headman pulls down the sleeves of his loose Indian style shirt, the kurta. Most north Indian farmers wear the traditional white garment and a turban for protection from the searing sun.

Good protection from the sun is indispensable in Bhai's village because further north begin the deserts of Rajasthan and there is very little rain even in the Monsoon season. Which means water is very scarce in Chorvadla and other parts of Gujarat. Only cacci and a few bushes of prosopis, or mesquite, a protein-rich fodder plant that grows in arid areas, put a bit of green into the dusty hill landscape. The riverbeds are dry most of the year.

Recently Gujarat was connected to water supplies from the controversial dam on the Namada River. That enables Bhai and the other Chorvadla farmers to grow sesame, sorghum and cotton on the better soils, and some own plantations of lime trees, all thanks to massive irrigation. An energy plant like jatropha would be highly welcome as another source of income. It would not have to take land away from food growing and would need only little of the precious water.

30 years of payback

Before the farmers can grow jatropha on a large scale the wild plant's behaviour has to be thoroughly researched. "The plant can do a lot of things, but hardly any breeding work has been done on it," comments Klaus Becker, a professor at [Hohenheim University](#) in Stuttgart. He's worked on jatropha for 15 years. There have been pilot projects for producing biodiesel from the oil fruit in Mali and Nicaragua. But the plant only recently attracted worldwide attention. Brazil's president, Lula da Silva, for example, announced that poverty in the northeast of the country would be combated with biodiesel from jatropha. Trials with the oil plant are also underway in China. "There are still no standardized seed, nor calculable yields nor adequately researched cultivation techniques," warns Scientist Becker, "but nowhere is all this being trialled as intensively as in our project."

For years the Indian research partner CSMCRI has collected lines of the plant and selected some "elite" specimens. These yield three to four times as much as conventional ones, whose average yield is a tonne per hectare. Given proper fertilization and watering, researchers expect double that.

Further testing of the plants is now going on at the Chorvadla plantation and another one in Orissa state. How much water and space do they need? What fertilization produces the best yields? The ground at Chorvadla is rocky, covered by only 20 centimetres of humus layer. "The plant can survive here without fertiliser or artificial irrigation," says Patolia, "but we want to optimise yields." He takes a few seeds out of one of the plastic bags hanging for documentation on each bush and spreads them in the palm of his hand. At first glance they look like dried black beans.

"For good yields we have to give each plant about 100 litres of water in the dry period," explains the scientist. In the starting phase weed also has to be removed and the farmers have to prune the plants. All parts of the plant are poisonous, but neither economically meaningful harvest, but after that it continues to produce for 30 years. From the soils at Chorvadla the scientists expect yields of about two tones per hectare-enough for about 500 litres of biodiesel.

Research in the maharajah palace

Jatropha is a shrubby succulent plant belonging to the Euphorbiaceae family. It originated in Central and South America but now grows worldwide in subtropical and tropical locations. The shrub or small tree thrives equally in very dry climate with only 250 millimetres of rain per year or in regions with rainfall of up to 2,500 millimetres. The hardy plant grows even on low-nutrient, stony soils.

"To optimise the economic returns for the farmers we have to find ways to use the entire plant," says Pushpito Ghosh, director of the Central Salt and Marine Chemicals Institute in Bhavnagar. Overloaded motorbike rickshaws clatter, camels pull heavy loads on the roads of the little town. Ghosh's institute is in an old maharajah palace. Two splendid Ambassador cars, the first model to be made in India, are parked outside the entrance with high columns.

In addition to biodiesel production the team of scientists and engineers also researches the use of by-products. They want to turn the oil cake left after milling the seeds into animal feed. For that the toxic plant has to be neutralised. Esterification of the oil, i.e. the process of chemically combining an alcohol and an acid, produces a large proportion of glycerine. The institute makes soap from it and by using bacteria tries to extract biopolymers from the mass, which might be used to make car seats.

Last year the institutes's pilot plant produced 8,000 litres of biodiesel, which meet the European industry norm (EN 14214) governing biodiesel composition. Its emission rates are comparable to those of biodiesel made from rapeseed. About €30,000 must be invested for a plant producing 250 litres a day, which farmers could raise if they joined together in cooperatives.

Apart from the research at the CSMCRI some jatropha biodiesel plants have started commercial operation. For example, in Maharashtra state the [IsonoxBio-Energy](#) company operates one. And the big players are also paying attention. Amongst others, the oil transnational [BP](#) and the Indian mega-corporation [Reliance](#) have shown interest in the research going on at Bhavnagar. That's already driven up the price of wild jatropha seed.

But India's demand for fuel is growing much faster. The country has to import most of its oil and pay dearly for it. Last year 40 million tonnes of diesel were consumed. This year's consumption is projected at 52 million tonnes. That's a huge market for the future fuel from the desert country of the small farmers in Chorvadla. That's also how village headman Vallhaba Bhai sees it. "We can hardly wait to grow jatropha." The others nod and smile. Their emaciated, deeply furrowed faces mirror the parched land they work.



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