Innovation Nation

SGB's jatropha vision: Jet fuel grown from seeds

By Jennifer Alsever November 26, 2012

An SG Biofuels worker examines the company's experimental jatropha crop.

NEW YORK (CNNMoney)

Call it the jatropha bubble.

When word got out several years ago about the promise of a small subtropical tree called jatropha, it became a biofuel sensation. Advocates claimed the fruit tree was hearty, drought-resistant and could be grown on marginal land. Its oil seeds offered a promising biofuel that wouldn't compete with food crops.

Air Japan, Continental Airlines and Air New Zealand ran test flights of planes using jatropha-based biofuel, prompting more than 100 companies to plunk down millions on jatropha plantations in developing countries. Energy giant BP (BP) **sunk $160 million into the farms**, and one industry group projected that $1 billion would be invested annually in jatropha.

Then everything crashed. Jatropha, it turned out, was much harder to grow than once thought. Yields were inconsistent, and many farmers didn't have the training needed to manage commercial-scale crops. **Most of the jatropha operations shut down**.

Except for a few outliers. While most of its rivals raced to commercialize the fuel, San Diego-based **SG Biofuels** took a different path: It hired plant geneticists. They hunkered down in the laboratory to come up with the best genetic variations of jatropha -- ones that would be more consistent, easier to grow and could produce more oil.

"We were impressed they waited until the plant science was there," says Darrin Morgan, director of sustainable biofuel strategy at Boeing (BA).

While the Seattle plane maker hasn't invested cash, Boeing has collaborated with the startup, sharing its own biofuel research and making industry introductions for SGB in Brazil and other markets.

Armed with backers like Boeing, $27 million from energy and biotech investors, and a team made up of former Monsanto executives and plant scientists, SGB is now testing its genetically boosted seeds in India and Brazil.

Plenty of observers are watching to see if it pays off.

"We have a strong desire to see SGB succeed," says Boeing's Morgan. "They're definitely the real thing."

SGB has had a few new-death experiences.

The company was launched by CEO Kirk Haney, a former tech executive who made a fortune when his employer, ArrowPoint Communications, sold to Cisco for nearly $6 billion. Haney was working at a friend's sustainable forestry company in Guatemala when a local told him about the promise of jatropha.

Like everyone else, Haney saw opportunity. But when he sought advice from University of California plant scientists about what seeds and soil to use, they had never even heard of the jatropha tree.

"He left and I started Googling it, trying three or four different spellings," says plant geneticist Bob Schmidt, now SGB's chief scientist. "The more I learned about it, the more excited I became about it."

But Schmidt ultimately told Haney that the existing, wild jatropha seeds wouldn't work. In his view, anyone hoping to profit from the plant would first need to fund a breeding and biotechnology program to develop hybrid seeds with higher yields that could grow in some of the most infertile ground in Africa, Southeast Asia and Latin America.

Jatropha was a perfect candidate for experimentation, Schmidt says, because it reseeds quickly and has myriad genetic variations from which to pull.

In 2008, the startup lined up $200 million from investors. Then the economy collapsed -- and so did the jatropha hype. Three weeks before the cash hit the bank, investors pulled out.

Haney frantically reached out to friends and contacts, seeking new backers, but no one would bite. To keep things rolling, Haney convinced the company's 10 employees to work for stock or take pay cuts and wrote a personal check to pay the company's research bills.

That move "kept us alive and focused," he says.

Over the next two years, Haney rounded up $9.4 million from angel investors and from Flint Hills Resources, a large petroleum and ethanol refiner, and Life Technologies Corp., a biotechnology tools company. Last year, venture capital investors put $17 million more into the startup.

Today SGB has 13 field trials of its hybrid seeds in Brazil, Guatemala and India, and it's trying to fill 20 executive and management jobs to expand those markets and move into Africa and Southeast Asia. The company plans to put a big emphasis on farmer education, selling not only its seeds but also its expertise, such as helping pick the best locations and conditions for the seeds. SGB plans to collect royalties on fuel produced from its seeds.

One new customer, JetBIO -- a Brazilian consortium of Airbus, the Inter-American Development Bank and TAM Airlines -- is optimistic about an ongoing field trial it's doing with SGB in Brazil.

"I think this will be game-changing in the industry, because what it really lacked was proper genetics," says Rafael Abud, JetBIO's managing partner.

Still, the company's fate is tied to many forces beyond its control, including potential changes in renewable energy policies in countries across the globe. Right now, demand for biofuel is huge, but SGB has a lot to prove, says Michael Cox, an analyst who follows the space for Piper Jaffray.

This time around, jatropha needs to prove it can be an economical alternative to conventional fuels.

"The plant needs to perform," says Boeing's Morgan. "If so, they're the beginning of jatropha 2.0."

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Start-Up Uses Plant Seeds for a Biofuel

By TODD WOODY

SAN DIEGO — In an unmarked greenhouse, leafy bushes carpet an acre of land here tucked into the suburban sprawl of Southern California. The seeds of the inedible, drought-resistant plants, called jatropha, produce a prize: high-quality oil that can be refined into low-carbon jet fuel or diesel fuel.

The mere existence of the bushes is an achievement.

Hailed about six years ago as the next big thing in biofuels, jatropha attracted hundreds of millions of dollars in investments, only to fall from favor as the recession set in and as growers discovered that the wild bush yielded too few seeds to produce enough petroleum to be profitable.

But SGB, the biofuels company that planted the bushes, pressed on. Thanks to advances in molecular genetics and DNA sequencing technology, the San Diego start-up has, in a few years, succeeded in domesticating jatropha, a process that once took decades.

SGB is growing hybrid strains of the plant that produce biofuel in quantities that it says are competitive with petroleum priced at $99 a barrel. Oil is around $100 a barrel.

Call it, as SGB does, Jatropha 2.0.

The company has deals to plant 250,000 acres of jatropha in Brazil, India and other countries expected to eventually produce about 70 million gallons of fuel a year. That has attracted the interest of energy giants, airlines and other multinational companies seeking alternatives to fossil fuels. They see jatropha as a hedge against spikes in petroleum prices and as a way to comply with government mandates that require the use of low-carbon fuels.

“It is one of the few biofuels that I think has the potential to supply a large fraction of the aviation fuel currently used today,” said Jim Rekoske, vice president for renewable energy and chemicals at Honeywell, who has visited the company’s jatropha plantations in Central America.

Mr. Rekoske and biofuel analysts say SGB’s biggest challenge will be to replicate the yields it generates in the greenhouse on a commercial scale.

“Given that this crop has somewhat of a checkered past, ultimately getting growers to plant the crop is going to be the key hurdle,” says Michael Cox, an analyst at Piper Jaffray.

At the greenhouse, the fruits of SGB's technology are apparent. A typical wild jatropha bush will produce a cluster of six to eight seed-bearing fruits, according to Robert Schmidt, a specialist in corn genetics who is SGB's chief scientist. He picked up a grapefruit-size cluster growing on a hybrid jatropha plant and counted 37 fruits. "We have examples in Guatemala where we have 60 fruits in a cluster," Dr. Schmidt said.

SGB's success at improving jatropha seed yields by as much as 900 percent persuaded a consortium that includes Airbus, BP and the Inter-American Development Bank to sign a deal with the company to plant 75,000 acres of jatropha in Brazil. The consortium, called JetBio, aims to develop sources of biofuel for the airline industry as the European Union, Australia and other countries impose caps on aviation carbon emissions.

"The demand is huge — every single airline would like to be flying on biofuel today," Rafael Davidsohn Abud, JetBio's managing partner, said in an email.

Jatropha's value as a cash crop, though, may pale compared with a potential genetic gold mine SGB has begun to discover, identifying traits, for instance, that make certain strains of the plant resistant to extreme heat or cold.

"If you figure out how to do heat tolerance for corn or soybeans, what is that trait worth as climate change accelerates?" asked Arama Kukutai, managing director at Finistere Ventures, a San Diego venture capital firm that has invested in SGB.

For now, SGB plans to license its technology to energy companies. But the company is securing patents on its hybridization process, creating a technology platform that can be deployed to discover genetic traits in other agricultural crops.

For instance, in November SGB signed a deal with the Yulex Corporation to use its molecular breeding technology to increase the yields of guayule, a wild plant harvested as a replacement for petroleum-based rubber.

The technology also could be used to domesticate wild fruits and vegetables, company scientists said. They said the technology has the potential to unleash a new green revolution for a world that will need to grow 70 percent more food by 2050, according to the United Nations, as agricultural productivity is slowing,

The seeds of Jatropha 2.0 were planted in fall of 2008. That year, early on Sept. 15, a Monday, Kirk Haney, SGB's chief executive, went into the living room of his San Diego home to prepare for what was to be a watershed week for his year-old start-up. That Friday, SGB was set to close a $200 million round of financing from European investors.

"I turned on CNBC and Lehman Brothers had just failed and the Dow was plummeting," said Mr.

Haney, 42, a technology entrepreneur with the laid-back demeanor and looks of a longtime California surfer.

SGB intended to use its financial windfall to plant sprawling farms around the world. Two days after Lehman fell, though, the investors had pulled out, forcing Mr. Haney and a team of top plant geneticists he had recruited from the University of California at San Diego to devise a new strategy.

Dr. Schmidt, SGB's chief scientist, had already concluded that jatropha showed little genetic diversity — a big roadblock to their plan because it would be difficult, if not impossible, to increase seed yields if all jatropha plants were essentially clones of one another.

Most jatropha bushes are descendants of plants grown on Cape Verde, an archipelago off Africa's west coast. Cape Verde became the epicenter of jatropha farming 300 years ago, and a single strain of the plant, then valued as living fence to corral livestock, was exported to tropical regions around the globe.

As Dr. Schmidt combed the scientific literature on jatropha, he stumbled across a reference to an obscure 30-year-old paper by the botanist Bijan Dehgan.

Dr. Dehgan had devoted his career to studying jatropha. He traveled the world collecting and cataloging the 175 species of the plant, speculating that the species originated in Central America.

Following up on Dr. Dehgan's thesis that Guatemala was a jatropha Eden, Dr. Schmidt went to Central America and began analyzing the genetic makeup of the plants there. "It was absolutely spectacular the amount of genetic variation that we collected from the center of origin," he said.

That discovery coincided with a plunge in the cost of DNA sequencing that has allowed SGB scientists to rapidly identify the most genetically diverse and productive plants and crossbreed them. It also lets them pinpoint profitable individual traits and mutations, like heat or cold resistance.

It costs SGB $350 to genetically map a single jatropha line to look for valuable mutations, a price that will drop to $50 in 2014.

The price five years ago? About $150,000, according to Eric Mathur, SGB's chief technologist. The machine that does the mapping cost $250,000 and is in SGB's laboratory in a suburban San Diego office park.

About the size of a small microwave oven, it is called a semiconductor sequencer and can map 10 to 15 plant lines at a time. It automatically compares those sequences with a master jatropha genome, which SGB spent $250,000 to create, to identify genetic variations that might indicate desirable traits.

“You simply could not do this three years ago without a really high cash flow out the door,” Mr. Mathur said.

To domesticate a wild plant, scientists traditionally crossbred two promising lines and hoped for the best, waiting for them to flower to see if the hybrid proved viable. The process could last for years if not decades.

SGB’s technology allows its scientists to identify potentially productive hybrids in the laboratory at the molecular level before the plants are crossbred.

“This used to be a 10-year discovery process,” Mr. Mathur said. “It’s more like a 10-month process now.”

Much of the hard molecular biological work is done, Mr. Haney said, giving SGB a five-year head start over any agriculture giant that might try to replicate its success.

“It doesn’t matter how much money you have,” he said. “You can’t make cells divide quicker.”