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Natural entrepreneur
Her dream is creating, selling biopesticides for organic farming

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Next time you see an organic tomato at half-again the price of a conventional one, blame weeds.

More than diseases or hungry insects, weeds account for the high cost of organic crops, farmers and industry experts say. Weeds crowd plants, steal nutrients and cut yields.

Conventional farmers can fight weeds with a menu of proven herbicides. But organic growers rely on hand labor, delicate plowing between rows, even spraying vinegar -- whatever they can come up with.

It all adds to the cost of that tomato in the store.

If the price comes down a few years from now, there's a a good chance Pam Marrone will have had something to do with it.

For 17 years, the Davis-based scientist and entrepreneur has scoured the world for the biopesticides made by microorganisms that live on plants and in the soil. Marrone concentrates these natural chemicals into products that fight weeds, insects and diseases and, ideally, cut the cost of growing organic crops.

With that vision, Marrone has built a string of three biopesticide companies in Davis: Entotech Inc., AgraQuest and now Marrone Organic Innovations. Her entrepreneurial achievement has won her a reputation as a leading innovator in the $600 million biopesticide industry.

Thomas Holtzer, a Colorado State University entomologist who co-directs the U.S. Department of Agriculture's Western regional pest management program, said Marrone has been a pioneer in turning the promise of biopesticides into money-making commercial operations.

"I just see what she's doing as so important -- getting that technology out there for people to use," he said. "I can't think of anybody that's done that at the level she has."

Marrone ties her passion for natural chemicals to a gypsy moth infestation at her home in rural

Connecticut when she was 7.

"You could go into the woods some years, and you could actually hear the insects chewing," she said.

"I remember walking out into the forest with no leaves and thinking, 'Well, this is what I want to do -- I want t! o find ways to control these things.' "

Mixed with that ! memory o f insect devastation is a picture of dead ladybugs and bees after her father, out of desperation, sprayed a powerful chemical to kill the moths on the dogwood in front of the kitchen window. Her mother, a committed organic gardener, put her foot down.

"She said, 'That's the first and last time you will ever use a chemical,' " Marrone said.

Marrone's father went back to what's known as Bt, an early and still-popular biopesticide. And Marrone, a first-grader, wrote a letter to the U.S. Department of Agriculture for information on careers in pest management.

She would go on to earn a Ph.D. in entomology at North Carolina State, chasing dreams of developing natural pest-killers.

But the early years of Marrone's career took her to what now seems an unlikely employer: Monsanto Corp., the St. Louis-based biotech and chemical giant that makes Roundup.

Beginning in 1983, Marrone contributed to Monsanto's early agricultural biotech program, which she saw ! as a chance to develop products that would control pests without using chemicals. She developed a way to raise corn rootworms in the laboratory, enabling company scientists to do the research that led to a blockbuster genetically modified variety of corn, engineered to produce chemicals toxic to the rootworm.

But as Monsanto intensified its focus on genetic engineering, Marrone realized she didn't want that technology to be her life's work. In 1990, she accepted an offer to lead the Danish corporation Novo Nordisk's new biopesticide venture in Davis, Entotech.

Five years later, Novo Nordisk sold the company, and Marrone set out on her own, founding AgraQuest with funding from family and friends.

She took no salary for the first two years as AgraQuest got off the ground. By September 2001, though, the company had a collection of promising products, including ones that kill fungus and molds, and Marrone was preparing for an $80 million stock offering.

! The IPO plans collapsed after the World Trade Center attacks. ! To keep AgraQuest afloat, Marrone had to yield control to a group of investors. She still wears a Little Engine That Could charm that her husband gave her that year.

AgraQuest eventually recovered. Its 2006 sales of disease-fighting biopesticides soared to

roughly $20 million, up 80 percent over the year before, according to company officials.

But as AgraQuest shifted its focus to commercialization and marketing, Marrone left in March 2006 to once again follow her passion: discovering biopesticides and turning them into products. She founded Marrone Organic Innovations several months later, and by April of this year announced she had raised $3.75 million from investors.

Marrone says her seven-employee company will focus at first on bioherbicides, which she sees as a wide-open market.

Paul Underhill, an organic grower who runs Terra Firma Farms near Winters, says he uses many different organically approved chemicals to fight insects and diseases, including one! of Marrone's creations from her AgraQuest days. But he says he has yet to find one that works effectively on weeds.

"There are definitely times when it would be nice to have an herbicide available," Underhill said. "But most of them have been very expensive, not very effective, and not very practical because you have to use such a high volume of material."

So far, Marrone Organic Innovations has just one product, GreenMatch O, on the market. The all-purpose herbicide is approved for use by organic farmers in every market except California, where it's under regulatory review. The company is working on dozens of others, including many it has licensed from scientists eager to get their invention into Marrone's product pipeline.

The timing for Marrone's latest venture, it seems, could hardly be better: Sales of organic foods in the United States hit $16.9 billion in 2006 and are projected to keep growing for years to come. The biopesticide industry is growing! in tandem, with conventional chemical companies and small independent firms like Marrone's vying for market share.

At 50, Marrone is now a veteran entrepreneur, confident but not cocky -- traits embodied in the "Take Command Pam" action figure the Sacramento Area Commerce and Trade Organization created in her image in 2000 to help sell the area's entrepreneurial culture to the outside world.

She keeps a stuffed Kermit the Frog above her computer at her headquarters, a hybrid office, greenhouse and laboratory squeezed into a warehouse strip in eastern Davis. That's right: It's not easy being green.

The very traits that make biopesticides appealing for environmental reasons also complicate efforts to make an effective, marketable agricultural product, Marrone said.

To start with, biopesticides -- which include herbicides, insecticides, fungicides and others -- tend to break down quickly when dried out or exposed to the sun. That means they probably won't end up on food in the grocery store, but at the same time, their effectiveness in the farm field can be short-lived.

Another problem: While a great deal of research has been done on how weeds and diseases

develop in conventional farm fields, and how to fight them, the opposite is true in organic agriculture, said Carolee Bull, a plant pathologist at the USDA's Organic Research Center in Salinas. Organic farm fields tend to be more complex systems, ecologically speaking, than conventional farm fields, so it's harder to predict how well any given chemical will work, Bull said.

Still, Marrone has shown she can overcome these sorts of challenges. And she said she still feels she has something to prove.

She works 60 hours a week and doesn't eat lunch. She takes a break for the Davis Farmers Market on Saturday, where she sometimes conducts impromptu focus groups with local farmers. She also keeps a vegetable garden of her own and her work spills over into that part of her life, too.

"I do test my creations," Marrone said.

Her search for a new biopesticide often starts with a bag of dirt. Boxes in her lab hold dozens of Ziploc bags full of soil from places where she or a colleague noticed that something ought to have been growing but wasn't: A bare spot in a creek bed in Inverness, a patch near her mother's house where the crabgrass wouldn't grow.

"You wonder what's in the soil that's making that happen," Marrone said. "You're looking for what produces a lot of microbes warring against each other."

Those conditions tend to favor unusual microorganisms that produce complex cocktails of chemicals that could be turned into a product.

And Marrone has a hunch that, somewhere out in the wild, there's a blockbuster biopesticides waiting to be discovered.

"It's not sitting in somebody's lab," she said. "If we're going to develop an organic Roundup, we're going to have to find it."

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Caption:
Sacramento Bee / Anne Chadwick Williams

Davis-based Pam Marrone has been called a pioneer in turning the promise of biopesticides into money-making commercial operations.

Sacramento Bee / Sharon Okada

Making a 'green' pesticide

Davis scientist and entrepreneur Pam Marrone turns natural compounds into biopesticides for

organic and conventional farming. Marrone is a leading innovator in the fast-growing industry, which now boasts annual sales of $600 million. Here's how she develops a weed killer:

(1) Marrone and her associates gather diseased or dying plants, as well as samples of soil from areas where plants would be expected to grow but don't. In these samples, they hope to find unusual microorganisms that impair plant growth.

(2) In the laboratory, her team cultures the microorganisms found in the soil and analyzes the chemicals they produce.

(3) The microorganisms is sprayed on a common weed.

(4) If the solution damages the plant, it's a candidate to be developed into a commercial herbicide.

(5) Next, Marrone's team must develop ways to make the natural herbicide compounds in large volume at a competitive price, ensure that the brew is compatible with existing pesticide-spraying equipment used by farmers and check its effectiveness on test fields.

(6) Finally, the product must be approved by state and federal pesticide regulators, as well as by the nonprofit Organic Materials Review Institute.

Source: Pam Marrone -- Marrone Organic Innovations

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