Caltech Studying Keys To Urban Hydroponic Farming, Roof Farms

POMONA, Calif. — Terry Fujimoto sees the future of agriculture in the exposed roots of the leafy greens he and his students grow in thin streams of water at a campus greenhouse.

The program run by the California State Polytechnic University agriculture professor is part of a growing effort to use hydroponics _ a method of cultivating plants in water instead of soil _ to bring farming into cities, where consumers are concentrated.

Because hydroponic farming requires less water and less land than traditional field farming, Fujimoto and researchers-turned-growers in other U.S. cities see it as ideal to bring agriculture to apartment buildings, rooftops and vacant lots.

"The goal here is to look at growing food crops in small spaces," he said.

Long a niche technology existing in the shadow of conventional growing methods, hydroponics is getting a second look from university researchers and public health advocates.

Supporters point to the environmental cost of trucking produce from farms to cities, the loss of wilderness for farmland to feed a growing world population, and the risk of bacteria along extensive, insecure food chains as reasons for establishing urban hydroponic farms.

However, the expense of setting up the high-tech farms on pricey city land and providing enough year-round heat and light could present some insurmountable obstacles.

"These are university theories," said Jim Prevor, editor of Produce Business magazine. "They're not mapped to things that actually exist."

The roots of hydroponically produced fruits and vegetables can dangle in direct contact with water or be set in growing media such as sponges or shredded coconut shells. Most commercial operations pump water through sophisticated sensors that automatically adjust nutrient and acidity levels in the water.

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Hydroponics are generally used for fast-growing, high-value crops such as lettuces and tomatoes that can be produced year-round in heated, well-lit greenhouses. So far, production is not large enough for the U.S. Department of Agriculture to track.

The country's largest hydroponic greenhouse is Eurofresh Inc.'s 274-acre operation in

southeastern Arizona, where more than 200 million pounds of tomatoes were produced in 2007. Most large-scale commercial operations are in the arid Southwest, where water-efficiency is prized, or the sometimes frigid Northeast, where the method can be used year-round in heated greenhouses.

The technology has benefited from nearly three decades of NASA research aimed at sustaining astronauts in places with even less green space than a typical U.S. city.

Hydroponics bears the dubious distinction of being a growing method for marijuana.

Fujimoto said one of his research assistants got a call from the FBI after using a credit card to buy nutrients for the campus greenhouse at a hydroponic-supply store.

There's clearly nothing illicit going on at the greenhouse, where thin streams of water pass silently though dozens of long white plastic tubes arranged in rows across chest-high stands. Rose-shaded lettuce leaves, pale-green stalks of bok-choy and sprigs of basil poke from the holes in the tubes.

Fujimoto aims to prepare his students to operate the urban hydroponic businesses that he thinks will gain importance in the future. They sell their lettuces, peppers, tomatoes and other produce to an on-campus grocery store and at a farmers market.

In Ohio, the ProMedica Health System network of clinics used a Toledo hospital roof to grow more than 200 pounds of vegetables in stacked buckets filled with a ground coconut shell potting medium. The tomatoes, peppers, green beans and leafy greens were served to patients and donated to a nearby food shelter, hospital spokeswoman Stephanie Cihon said.

When the project resumes in the spring, the hospital plans to expand into at least two community centers in economically depressed central Toledo, where fresh produce is hard to come by.

"From the health-care perspective, the more we can increase people's lifestyle changes and encourage them to eat better, it's going to impact our services greatly," Cihon said.

In a New York City schools program run by Cornell University, students grow lettuce on a school roof and sell it for $1.50 a head to the Gristedes chain of supermarkets.

Cornell agriculturist Philson Warner, who designed the program's hydroponics system, said his students harvest hundreds of heads of lettuce a week from an area smaller than five standard parking spaces by using a special nutrient-rich solution instead of water.

The numbers have some researchers imagining a future when enough produce to feed entire cities is grown in multistory buildings sandwiched between office towers and other structures.

Columbia University environmental health science professor Dickson Despommier, who champions the concept under the banner of his Vertical Farm Project, said he has been consulting with officials in China and the Middle East who are considering multistory indoor farms.

He is also shopping his concept to engineering teams in hopes of having a prototype built as he seeks funding.

"Most of us live in cities," he said. "As long as you're going to live there, you might as well grow your food there."

Great Ideas have always faced violent opposition from mediocre minds.