The McGuire's planted their high tunnel trees in 2019 and kept them for three growing seasons with harvests in 2020 and 2021.

High Tunnel Apple Production Doesn't Pay

Chris and Juli McGuire put unused high tunnels to work growing organic apples on their Two Onion Farm. Funded in part by a USDA-SARE grant, they spent several years evaluating the practice's potential.

"Most of our results were neutral to negative," says Chris McGuire. "I'm not saying the whole idea is really bad, but you have to select specific varieties that tolerate the heat. Perhaps two of the seven varieties we tried were suited for it. The others were mushy with off flavors and sunburn."

When McGuire totaled up the costs of high tunnel construction and maintenance, heat-related fruit defects, and the need for sprays to control insect damage, the idea simply didn't pay. While diseases were absent or rare, insect damage was similar to what they saw in outdoor trees.

"Before the research grant, we had raised nursery apple trees for a year in high tunnels before transplanting them to permanent locations," says McGuire. "We were impressed by the vigorous growth and absence of disease. This motivated us to consider growing them permanently under high tunnels."

The couple has been raising organic apples for the past 10 years, as well as currants and gooseberries. When they started farming in 2003, they focused on organic mixed vegetables. The high tunnels had previously been constructed for use growing vegetables at a cost of about $10,000 and 180 hrs. of labor.

They planted their high tunnel trees in 2019 and kept them for three growing seasons with harvests in 2020 and 2021. They planted 13 trees of each of the seven varieties. Tunnels were covered with an opaque silage tarp over winter. Average yields were 7 lbs. per tree in 2020 and 25 lbs. per tree in 2021. Five of the varieties were common heirlooms that are in high demand. However, disease susceptibility keeps the McGuires from growing them outdoors. Two more modern varieties with some disease resistance and heat tolerance were also planted.

Detailed information is available in the SARE research report online.

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He Built His Own Potato Bug Sweeper

After his 2021 potato crop was devastated by Colorado potato beetles, Jason Matthews knew he needed to do something. Operating a chemical-free farm, he figured out a mechanical solution. Over a couple of afternoons, using parts from a La-Z-Boy chair, lawn mower, signboard, belting, and a bucket, he rigged up a bug sweeper. Though not ideal, it helped, and by mid-July, he and his wife, Lisa, were selling tennis ball size Superior potatoes at the farmers market and their J&L Farms stand on Prince Edward Island.

Matthews based his bug sweeper on a walk-behind model he had seen in a potato museum. He designed his to be ground-driven and pulled behind a tractor. The lawn mower rear axle runs between the potato rows and the chair frame fits perfectly with holes that line up with a lawnmower spindle that spins a piece of belting to knock bugs into a 5-gal. bucket cut in half and bolted together.

He pulled the sweeper through his acre of 220-ft. rows of potatoes once or twice a week when the bugs started coming.

"Because it was ground-driven, it required driving extremely slow," Matthews says, and it only swept one row at a time.

Jason Matthews' bug sweeper manually sweeps bugs into a container without the use of pesticides.

"I plan to build it larger to do four or six rows and make it PTO that will allow height and speed adjustments," he says. "Also, I will run a piece of cloth for the bugs to hit, to absorb the impact."

Many of the bugs hitting the sign board bounce to the ground or even hit him, Matthews says.

Despite its flaws, the bug sweeper helped. The plants had better looking leaves and produced nice size potatoes.

"It generated a stir in the community," Matthews says. "Most farms reach for the chemical tool, and we like to rely on physics."

A video of the bug sweeper in action is on J&L Farms' Facebook page.

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Photo courtesy of Bakersfield Californian and Eliza Green

Exhaust from a propane generator and several vehicles is collected and fans funnel it through a system of ducts. The cooling system uses water from a children's pool, a pump, a sprinkler and a condenser.

Carbon Dioxide Used To Increase Orchard Yields

Can you double or even triple yields by swamping orchard crops with CO2? Brian Kolodji may have the way to do it. He floods orchards with diluted CO2 several times higher than that in ambient air, and keeps it there for extended periods.

Researchers and greenhouse growers have long shown high levels of CO2 can boost yields, sequester carbon and improve water use efficiency in crops by 10 percent. Kolodji's simple process lowers costs by a factor of 20.

In addition to reduced costs, Kolodji hopes to match or exceed results from a previous 17-year FACE study with CO2 in citrus. It demonstrated a 70 percent increase in yield on average.

"If you took out the first 6 years when the new trees were maturing, the yield increase was 100 to 200 percent," says Kolodji.

He notes that the citrus research was at a low level of enrichment, only 550 parts per million (ppm) versus CO2 levels in ambient air of 400 ppm. He has delivered as much as 1,500 ppm for 8 hrs. in multiple trees.

"We've proven it can be done and more cost-effectively than ever before," says Kolodji. "Our process brings the cost down to less than $1,000 per acre, compared to the $2 to $3 million an acre cost in the citrus study. Eventually, I expect to lower it to less than $500."

Kolodji has multiple patents on the process, but his prototype system installed in a California almond orchard is seemingly simple. Exhaust from a propane generator and several vehicles is collected and fans funnel it through a system of ducts. The cooling system uses water from a children's pool, a pump, a sprinkler and a condenser. Flexible tubes distribute the CO2 into the tree canopy.

Passing the CO2 through the water vapor cools the hot exhaust gas down to 80 degrees. The condensation process also takes water out of the flue gas. This raises the molecular weight of CO2 above that of air. When distributed around trees, the heavier CO2 displaces the air, and the multiple distribution points reduce the velocity of the gas.

"The trees act as baffles, reducing air movement, and the distribution reduces the velocity of the gas," says Kolodji. "We point it into the trees where it hovers and then slumps to the ground for extended periods."

While the system has been shown to work, application of the CO2 has not been consistent enough to prove yields. The next step is to utilize flue gas from a refinery across the street from the orchard. Currently, the refinery sends up to 200,000 tons of CO2 up its stacks each year.

"We propose to use the flue gas in the orchard," says Kolodji. "We could use it to feed CO2 to 1,000 acres."

Initial work on the project was financed in part with a $100,000 grant from the state of California. Kolodji is seeking additional funding to access the refinery's exhaust and prove increased yields with his system.

"If we could get CO2 from refineries, we could swamp our orchards," he says.

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