Research Report

Lou Lego Battles the Downy Mildew Spore and Wins!

—Jill Slater, Northeast Organic Research Symposium Coordinator

A creative farmer finds an ingenious solution to a difficult disease problem.

The NOFA-NY Organic Research Symposium in January 2012 brought together a great group of academic researchers, farmers, and on-farm researchers as well as gardeners, journalists, and students. One of the on-farm researchers who presented is Louis Lego, owner and farmer of Elderberry Pond. Elderberry Pond is a 100-acre farm replete with 100 varieties of apples, vegetables, herbs, and cut flowers, as well as heritage pigs and chickens. Lou, who also served on the Symposium's Advisory Board, presented a poster on growing scab-free apples without fungicides and participated in a couple of round-table sessions highlighting the ups and downs of on-farm research.

In March of this year, Lou was awarded a SARE grant to test a downy mildew spore-resistant hoophouse. This was the tenth grant award that Lou and his wife, Merby, have received over the past 20 years. In fact, the Legos have never had a grant request rejected! They take the application process very seriously and enjoy the financial and outreach opportunities these grants afford. A few of Lou's favorite past grants supported his efforts to build a small-scale cider pasteurizer, to innovate fungicide-free growing practices for apples, to perfect a mulching technique that would preclude bringing straw into the field, and to start a restaurant on his property that would serve the sustainably grown vegetables, fruit, and meat harvested onsite.

Tomato plants in Lou Lego's experimental spore exclusion hoophouse are disease free. *Photo by Merby Lego*

Outsmarting a Dreaded Disease

Lou and Merby sought their present SARE grant in response to an unfortunate trend Lou recognized a couple of years ago. Many of his fellow farmers' entire cucurbit crops were dead by midsummer! Spores of the fungus that causes downy mildew were bouncing up out of fields of winter squash and summer squash in Maryland and the Carolinas and traveling north on wind currents. In rainy or foggy conditions, the spores then rained down on fields, and the resulting explosion of disease killed cucurbits through the Northeast. "These Southern farms used to be fine," explains Lou. But now the high volume of pesticides used have resulted in widespread pesticide resistance in the downy mildew fungus, and thus greater spore production.

A useful but bittersweet outcome of this spore invasion are the computer models and weather models developed by North Carolina State University (NCSU) to carefully document, quantify, and locate the spores' whereabouts. Farmers on the spores' path receive daily e-mails from the university as to the status, impact, and travel patterns of the downy mildew spores. However, also these e-mails keep a farmer informed, there is little recourse once the spores arrive. Lou didn't want to just sit by and watch as his cucurbits were decimated. He wanted to be able to take advantage of this incredibly precise warning from NCSU and arm himself and his fellow farmers with a proactive tool. Thus began Lou's exploration for a solution.

The first step was to find out the actual size of a downy mildew spore. How does it compare to pollen or other airborne particles, for example? Well, it turns out that, at 2 microns, the spores are relatively large—larger than cigarette smoke and pollen. Lou thought the common filters sold at Home Depot for the purpose of trapping cigarette smoke might be adapted to his purpose as a spore barrier. A couple of summers ago, Lou built a little plastic hoophouse with a filter installed in one end wall and a small exhaust fan at the other end. Success! There were no spores in the tunnel and his small sample of cucumbers planted inside was unharmed.

Once he witnessed how successful the off-the-shelf filter was at sparing a lucky batch of

This computer-controlled apple cider pasteurizer is another of Lou's inventions developed through a SARE research grant. *Photo by Merby Lego*

cucumbers, Lou wanted to expand the scope of the experiment. The SARE grant supplied funding to build a large (30 feet by 100 feet) hoophouse—complete with filters—over outdoor raised beds. Cucumbers grown in that hoophouse would be compared to a control crop grown in a regular hoophouse without filters. Both houses were equipped with roll-up sides, so that the houses could remain connected to the outside environment until such time as the downy mildew spore warnings were issued. Unlike the majority of the cucumbers grown in greenhouses throughout the United States and Canada, Lou's cucumbers were exposed to the elements. The flexibility inherent to a hoophouse design means that for the majority of the season, Lou's crops are essentially outside—surrounded by just the metal skeleton of a hoophouse.

The fans in the end wall of the experimental hoophouse worked to pull air through the filters on the other end, thus establishing slightly pressurized conditions. This allowed Lou to freely open the door to the hoophouse and enter the space without worrying about unfiltered air infiltrating the house and contaminating the protected cucurbits.

Lou's Design Saves the Crop

Lou completed construction of the two hoophouses by early summer of this year—ready for an early onset of spores. In fact, the first warnings from NCSU didn't occur until late August. While his cucumbers had enjoyed fresh air and direct natural sunlight all summer long, it was time to roll down the plastic and batten down the hatches on both hoophouses. As soon as the fog lifted or the rain subsided, and North Carolina State's models declared the air to be spore-free, Lou lifted up the sides of the hoophouse, and as he likes to say, took his crops out of "spore exclusion mode."

Like Lou's initial trial, this grant-funded large-scale experiment was a great success. The cucumbers inside the filtered hoophouse were delicious—completely unmarked and spared of any and all signs of downy mildew. Those inside the filter-free hoophouse were ravaged by downy mildew.

Lou is delighted that his relatively low-tech solution frees farmers from the limitation of focusing solely on disease-resistant varieties of cucurbits. They can choose to grow heirloom varieties, or any variety they prefer. Widespread adoption of filtered hoophouses would also preclude the need for extensive efforts on the part of universities to breed downy-spore resistant plant varieties.

Most grants require an outreach component. In this way, the grantee ensures that as many people as possible learn about the farmer's discovery, new product, or innovative growing practices. Some on-farm researchers dread this part of the grant process, but lucky for Lou, he loves sharing what he's learned. For this grant, Lou held on-farm workshops to demonstrate how to build a downy-mildew-resistant hoophouse; he and Merby hosted tours of their farm; and Lou plans to deliver a paper on the experiment at upcoming conferences.

Lou knows that, as a farmer, he's got firsthand knowledge of what works and what doesn't. Luckily, there are many grants available that support on-farm research, and there are farmers like Lou who are challenged and driven to find solutions. His curiosity and creativity benefit many farmers, and in the end, make our food taste that much better!