



Why are Vermont Scientists Forever Blowing Bubbles?... To Find New Ways to Conserve Energy in Greenhouses.

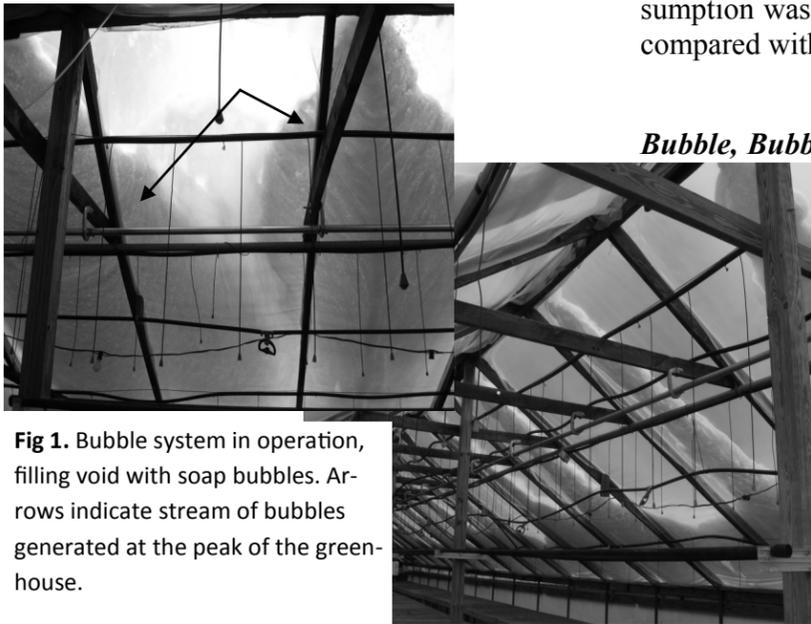


Fig 1. Bubble system in operation, filling void with soap bubbles. Arrows indicate stream of bubbles generated at the peak of the greenhouse.

Greenhouse growers know that energy conservation is good for business and the environment. Despite the threat of global warming, the cost to keep greenhouses warm in the frigid winters of northern New England is staggering, and continues to rise. Energy consumption either to heat or cool greenhouses is one of most significant production costs growers must pay to grow high quality crops and compete with operations in warmer locations. The New Hampshire Plant Growers Association, Horticulture Endowment Fund, funded research by scientists at the University of Vermont Entomology Research Laboratory (UVM), to refine and improve on the design of a novel energy conservation system using soap bubbles to insulate a plastic-covered gable style greenhouse. This is a unique device that generates soap bubbles to fill the space between the two layers of plastic covering the house and is reported to increase the R value from 1-2 to over 30 (Fig. 1). In 2001, a grower constructed one of the first hoop greenhouses using bubble insulation in Ontario where winter temperatures commonly reach -22°F. He reduced propane heating costs from \$1,137 to \$146/year. These results led UVM scientists to further investigate the energy efficiency of this



Fig. 2. Thermal curtain in empty gable-roof greenhouse (insert shows the open curtain).

system and compare it with a thermal energy curtain (Fig. 2) and an unimproved house in separate side-by-side 4,000 sq. ft. greenhouses heated with natural gas at a commercial operation in Vermont. Gas usage and other environmental and energy use factors were measured to evaluate the effectiveness of devices.

The Curtain is Up! A heat retention/shade curtain with an automatic operating system was installed in October 2010 (J.C. van der Spek Greenhouse Services, Berlin, CT) in time for testing during the fall poinsettia crop. Whereas the cost of retrofitting the curtain in the preexisting structure was fairly expensive, the owner was extremely pleased with the system, estimating that gas consumption was cut in half in the curtain house compared with the unimproved house.

Bubble, Bubble, Toil and Trouble. The bubble insulation system is not an off-the-shelf product and has been challenging to put into operation. It was necessary to adapt it for use in the test greenhouse. A system suitable for a hoop or gable style house is not available commercially. We obtained a prototype designed for a gutter-connected greenhouse (from Sunarc, Laval, Canada), which required major retrofitting. The bubble system has been in operation

over the past three winters, during which time several problems have surfaced that required adjustment. The most significant issue has been leakage of the soap solution. Each year improvements have been made so that the system will operate more smoothly, and its value in terms of reducing energy costs can be demonstrated.

Don't Burst My Bubbles. In 2012 gas use in January and February was 34% less in the house with the bubble system and 20% less in the house with the curtain than in the unimproved control house. Gas use was 17% less in the house with the bubble system than in the house with the curtain. That was one of the mildest winters on record which isn't a true test of the potential of these energy conserving systems, but even so, the owner spent \$741 less on gas in the bubble house and \$550 less in the curtain house than in the unimproved house. Savings would be even greater for greenhouses that heat with propane or oil, which are the more common fuels used by greenhouse growers in New England. These preliminary results clearly demonstrate the promise of the bubble system for conserving energy and saving growers money, though improvements in the system are needed before it is ready for commercialization.

What's On the Horizon? Support from the NH Horticulture Endowment has been instrumental in moving this cutting-edge technology forward. To gain more data on the system, this project will continue for another year with funds from the owner of the Sunarc design, now located in Israel. An engineer will also be employed to assist with design improvements to the system. A demonstration day will be organized in late 2013 to show growers region-wide how these energy conservation devices work.

The chill of winter is fading, but it won't be long before it returns. The potential of bubbles should give greenhouse growers hope for a future of lower energy costs. Mark Twain once asked, "I wonder how much it would take to buy a soap bubble, if there were only one in the world." Rest assured that as long as there is a bubble greenhouse, there will always be plenty of bubbles to go around.

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Join Chris Beytes and your New Hampshire Plant Growers friends at Spring Ledge Farm in New London, NH on July 23rd from 3-7pm. Come and tour this diverse growing operation, featuring field grown produce, greenhouses and their farm stand. Stay to dine on Spring Ledge grown produce and other local sourced food. For registration information, visit the NHPGA website.



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