'Lively Up' Winter Harvest: Basic Principles of Operation

The 'Lively-Up' Winter Harvest greenhouse is constructed of standard twelve-foot high aluminum greenhouse hoops 4' on centre bolted to the inner foundation, covered in greenhouse plastic. The vertical end walls extend 21 higher than the hoops. The outer foundation is spaced 30" from the inner wall, forming 3' deep trenches for soap solution storage down the two long sides, joined to each other with 4" pipe. This holds a total of 20.000 litres (41,700 Ibs.) of thermal mass, which is solar heated in the winter, and the water is kept in constant circulation with a 20 gpm. submersible pump. The ridge member at the peak is a lightweight aluminum, open web parallel truss that spans from one end wall to the other. The ridge joist is 2 in depth, with the top chord used to attach the exterior plastic sheet.

The interior and exterior sheets of plasticare spaced apart to create a roof/wall cavity space on each side of the joist. The outside sheet is stretched outward by pressure created in the sealed cavity space by a small blower that provides static pressure and compensates for any leakage of air-pressure. The outer plastic sheet arcs to the exterior wall of the footing, where poly-lock holds the sheet continuously.

Thus the double plastic covering along each side of the center ridge forms two arching cavity spaces separated by the ridge beam air barrier. Typically the greenhouse will be orientated with the ridge pointing east/west. This means there is a South facing roof/wall and a North facing roof/wall. Bubbles are created by water-driven high expansion foam generators connected to a 40 gpm. pump. There are two foam generators, one at each end of the ridge joist near the end walls. The foam generators are mounted on the joist -through the openings in the web members - with one unit facing into the North roof/wall and the other facing into the South roof/wall. Air can pass through the body of each generator to move from the one cavity into the other.

When one of the foam generator operates, it takes air from the opposite roof/wall and transforms this air into bubbles that flow into the cavity. The bubbles will fill at a rate of about 2000 cfm., taking little more than a couple of minutes to flow along the 50-foot length of the roof/wall, filling it to the peak. As the bubbles flow into the North roof/wall, air in the cavity has to move into the South cavity through the body of the foam generator at the opposite west-end of the ridge joist. If both foam generators operate at the same time they grab the air from the opposite side roof/veil and both cavity spaces fill with bubbles at the same time. When the bubbles fill to the end and up to the peak (the high expansion bubbles have almost no weight and show no tendency to slump down) the bubble generating cycle is finished. The foam generators shut off and the bubbles will remain for hours in place in the cavity. The liquid forming the bubbles will gradually drain down and they will become thin walled and almost transparent before they dissipate completely. As the bubbles dissipate they can be re-supplied by operating one or both of the Foam generator. The operation of the bubble cycles can be automatic, using simple electronic controllers.

Shading can also be accomplished with the foam solution, collecting solar gain while protecting the plants from excessive heat and eliminating the need to ventilate for temperature control. A series of mist sprayers along the ridge can be utilized as needed to cool interior temperatures or remove soap bubbles while collecting solar heat, which is stored in the insulated thermal mass containment system for later use. Previous research has shown the interior temperature of the greenhouse will be the same as the temperature of the thermal mass when the bubble generation system is in effect.

Irrigation is provided by a built-in rainwater collection system which pumps precipitation into a raised 1500 litre plastic tank inside the greenhouse. This water creates additional temperature-stabilizing thermal mass that keeps the foam generators from freezing while providing gravity-feed irrigation for the plants.