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Editor, Richard E. Widmer

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THE AIR-SUPPORTED GREENHOUSE

Don Piccard
G. T. Schjeldahl Company, Northfield, Minnesota

Parallel to the great invasion of plastics into everyday living has come the adoption of many new films for horticultural uses.

Air-supported buildings, or balloon houses, which were first made of rubberized canvas, are now being commercially fabricated from clear plastic films. At the same time as these were being developed for swimming pool enclosures and light manufacturing facilities, Professor Emmert at the University of Kentucky was making experiments with all available films for hot caps, cold frames, and finally for the glazing of framed greenhouses. His results indicated that common clear polyethylene and the DuPont's polyester, "Mylar", were both suitable for efficient use. The light transmission of the growing rays of the sun, the ease of handling due to light weight, and the resistance to storm and hail damage were all to their benefit. Therefore, it would be interesting to see just what has been done in the development of the plastic air-supported structure.

The first all-plastic bubbles were made in the shape of a pure hemisphere - taking their form from a half-inflated balloon, the earlier product of the manufacturer. With the desire for more floor space it was found that a cylindrical section could be introduced in the center of the bubble to elongate the structure without destroying the smooth equalized stressing of the film. When one attempts to inflate a box-like fabrication under even a small pressure, wrinkles develop and there is gross uneven distribution of the stresses. This means that part of the film is heavily overloaded, and other parts are relaxed. The overloaded parts naturally fail.

Cost analysis of this new shape - cylindrical, with bulbous ends - showed clearly that the cheapest floor space was within the rectangle covered by the cylindrical section of the balloon. It is also obvious that space is normally available in rectangles, not circles or ovals. If there were some way to eliminate the costly and wasteful bulbous ends, we thought we would have a more economical and more efficient structure.

With the introduction of a "solid" end wall in place of the other ends, we discovered an added advantage. These new end walls absorbed all the strain in the longitudinal direction caused by the supporting air pressure. No longer did we have a building stretched in all directions like a toy balloon (and capable of bursting like one), but we now had an enclosure that was not inherently prone to tear in any but just one direction.

If we could find a special film that had strength in one direction and great tear resistance in the other direction, then we would have an ideal condition. Although there was no such weatherable film on the market, the Minnesota Mining and Manufacturing Company developed one for us. We felt that this example of a large industry bending over backwards to help a rather small company was a great tribute to our American way of doing business.

In the process of glazing in the "solid" end walls, which were made of vertical two by four studdings on two-foot centers with a one by four semi-circular cap, we followed what seemed the natural procedure. We stapled two-foot wide film to the studs and then cleated it down firmly with one by two's. This, of course, is the way one would work with such films on a frame greenhouse and seemed perfectly normal to us until we again looked at the cost. In such cases, we now fabricate the film into one large semi-circular disc and apply it in one piece. This presents an interesting thought. If it is more economical to make one big sheet to apply to a frame structure, and if, when you have one big sheet you can support it by a small blower (needed anyway in today's modern greenhouse), then why go to the expense of the frame structure in the first place? We were on the right track with our combination frame (at the ends only) and air-supported building.

Since the whole structure is made from one welded piece, there are no uncontrolled cracks where heat and moisture have a desire to escape. Economy is, therefore, found in heating and time is saved in watering. Evans Halstrom has found that his watering labor has been drastically cut and that his stems are much stronger - not pulpy. Care must be taken to prevent dripping of the condensate from the center of the overhead. A plastic curtain hung horizontally in this area easily takes care of it. Condensate in other areas runs down the sides and does not bother at all.

The choice of material used in the construction of an air-supported greenhouse depends upon several factors. The size of the structure, the total life required, and the length of time that the building is to remain erected each season are the most important. Capital available, foundation facilities, and quality of handling care should also be considered.

Plain clear polyethylene is cheap and requires less fabricating labor because of its availability in large sheets. It is, however, short lived and easily damaged. Its low strength limits the size of the structure drastically. The Minnesota Mining and Manufacturing Company film - called reinforced "Scotchpak" in rolls, or "Schjelskins" when fabricated in ready-to-install large sheets by us - is much longer lived but more expensive.

A small building which is to be erected and deflated by the owner himself and which is exposed to the deteriorating effect of the sun only in the winter or spring can most efficiently be made from plain polyethylene. A building that is to be crudely handled by employed personnel, left up for several years at a time, or is of a larger size should be fabricated from the reinforced "Scotchpak." Such a structure also has much more resistance to violent storms and can be patched to 100 percent of the original strength, using common tools when it does become damaged.

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