LARRY CARVILLE: I assume the temperatures you gave are air temperatures; did you use any bottom heat and what was your shade factor under the milky poly which you used?

J. SLEZINSKY: We used no bottom heat, the temperatures were air temperatures, and we made no light measurements under the plastic so I can't tell you what the shade factor was.

RICHARD BOSLEY: You mentioned noticing mineral deposits on the leaves of cuttings under intermittent mist; did you analyze the water?

J SLEZINSKY: No, we did not. The water is that supplied by the University and I do know that it is high in calcium.

PRESIDENT TUKEY: Thank you Jim; we will have to hold the rest of the questions for the Pot Pourri.

Our next talk is about low cost propagating structures and will be presented by Carl Orndorff.

LOW COST PERMANENT PROPAGATING STRUCTURES

CARL ORNDORFF

Kalmia Farms Nursery
Clarksville, Maryland 21029

This is not an experimental project, but the reporting of the changes and upgrading of our propagating facilities over a 15 yr period at the Kalmia Farms Nursery at Clarksville, Md.

Low cost does not mean only construction costs, but also general maintenance costs, operating costs such as heating fuel and general labor operating costs.

Our firm operates a 328 acre wholesale nursery, growing mostly winter hardy woody plant materials in medium and large sizes. We cater to the landscape contracting business in the Mid-Atlantic area, with 90% of our business in a 50 mile radius that covers the Washington and Baltimore markets.

Our firm was originally in a rural area, in what is now the suburban Maryland-Metropolitan Washington area. During the late 1950 period, we moved to the rural area 20 miles west of Baltimore and 25 miles north of Washington. Again Washington and also Baltimore are moving in on us very fast.

In the late 1950 period, we had to start a new propagating facility at our new location. We had on hand one new 52 x 23 ft conventional "A" frame glass house. This we erected as a starter

at our new location, with plans to add several larger houses. At about this time several new products and new methods of propagating became available. This caused us to take a long hard look at our future facilities and methods. We have since built four additional 72 x 20 ft houses.

We considered seriously the following before building these houses:

1. Cost of building materials and amount of construction labor required.
2. Reducing the cost of maintenance; especially, reglazing, repainting, and general repair costs.
3. Increasing the general efficiency of the buildings, especially reducing heating costs. Also, increasing the ratio of useable area to total area.
4. Reducing operating costs by using labor saving devices, such as gravity conveyors, automatic controlled heating, automatic controlled ventilation, automatic watering, improved feeding methods and improved shading methods.
5. Also, such problems as non-drip ceilings involving condensation, long-life non-drip elevated benches and the elimination of fungus from walls, walks and benches.
6. Our most serious consideration was having a heavier and stronger plant to go directly to the fields. Our aim was to harvest a larger percentage of saleable plants and cut the time from planting to harvest and to have a superior product to sell at harvest.

With these objectives in mind, we made the following changes from our former facilities and methods:

1. We changed our design from the conventional "A" roof to a flat roof and placed each house against the next with common side walls. This reduced the exposure to cold weather to only the flat roof and the two ends. This exposes about 65% of the area of a normal "A" frame house. We also lowered the roof to between 7 and 8 ft to lower the volume of heated area. Our roof drainage grade was one inch of fall per foot. We considered curved or "Quonset" type designs but vetoed these because of larger area exposure and the more serious problem of snowload. Six to eight foot drifts are common with us.
2. Our next change was from glass to sheet fiberglass for superior insulation, lower labor installation costs, elimination of glazing and reglazing costs, elimination of air and

water leakage, the lower cost of shading and the ability to withstand our extreme snowload. Fiberglass is reasonably elastic under snowload, while glass will break easily. Our shading is 55% polypropylene netting, bound and eyeleted, fastened flat on the fiberglass. This is used from April to October and is easily put in place and removed. The life expectancy is unknown, but indications to date are extremely good.

3. Another change was the elimination of all painting of wooden parts, this being replaced by treatment with **water-based** copper wood preservatives. This saved painting and repainting and also greatly lengthened the life expectancy. We have in use treated greenhouse benches of western white cedar up to 14 yrs old, still in perfect condition. This is far superior to the expensive cypress and redwood lumber. Also for ungalvanized metals, we changed from enamel metal paints to primer metal paints with red lead or zinc chromate base to reduce the frequency of painting.

   An unanticipated payoff has been the elimination of all fungus on or in the houses, benches, pots or plants. We have found none of any type at any time. No fungicides have been used. We do not know if it is due to the fungicidal characteristics of the wood and metal preservatives, to the light and insulation factors of the sheet fiberglass or the design of the flat roof buildings with their absence of condensation drip. We installed a turbulating fan in our first fiberglass house to take care of ceiling condensation and drip, but found it unneeded.

4. Other savings in both construction materials and construction labor was the elimination of all poured concrete. Building blocks laid with mortar was used only where earth retaining walls were required. Elsewhere all walls and footings were building blocks laid dry and filled with washed pea gravel for locking in position. Building blocks were laid on the side and used for all walks and steps. These automatically became the edgings for all ground beds; therefore serving a dual purpose.

5. A most profitable change was the doubling of useable space by using both elevated and ground beds. Elevated beds 36" to 42" tall and 32" to 36" wide are used over ground beds 36" to 42" wide. This gives excellent light to the ground beds, which are used for plant materials having low light requirements, for seedling flats and for root cuttings. This system cannot be used in "A" frame houses

unless the sidewalls are extremely high; which then adds heavy additional heating loads.

Bench floorings are of treated 6" wide western white cedar, laid crossways, spaced 1" apart, and covered with 1/8" galvanized hardware cloth. Edge boards are the same 6" material. All beds are filled to the top with coarse perlite. This has a dual purpose, acting as a mulch and checking all drip into the ground beds. Also perlite is used because of light handling weight, sterile quality and high water absorption but slow water release.

6. Additional changes of more common useage were from conventional lift type ventilation to exhaust fans with soft plastic input distribution tubes. Yeating is oil-fired hot water with separate thermostats and circulating pumps for each house. One line of 1-1/2" fin type radiation goes around the perimeter of each house under the elevated beds.

   Watering is by automatic mist in the rooting house and by hand in the growing areas. Due to the use of perlite, hand watering is required only about once weekly in the summer and every 2 to 3 weeks in winter. Feeding is by a simple siphon system, therefore clogging prevents an automatic mist system being used in the growing areas. Sprinkler heads cannot be used due to excessive water on dual height beds.

   Gravity conveyors for handling filled flats lighten our work load.

Have these changes made any problems? None of serious consequence. Our largest, but very infrequent, is snow removal. We have had 4 ft of drifted snow on part of the roof. Snowload weight is not the problem. Insulation is so good, we cannot melt the snow by raising the interior temperature. If ambient temperatures are reasonably high after a snow fall, it clears quickly. If daytime temperatures remain low, hand removal may be necessary.

To summarize the results of our planning and almost unbelievable luck, our most important result at this time of energy crises seems to be the saving of heating fuel. Insulation and sealing is so efficient that the thermostats call for heat during the day only on the most extremely cold and windy periods.

An analysis of our fuel consumption as we expanded is as follows:

1. Three years operating only the "A" frame glasshouse, 52 x 23 ft, we consumed an average of 2659 gal/yr.

2. Two-year average consumption for the glasshouse and our first fiberglass house, 72 x 20 ft, was 3570 gal/yr. This is above our total average but both years were extremely cold with frozen ground 2-1/2 to 3 ft deep.
3. Five-year average consumption for the glasshouse and two fiberglass houses both 72 x 20 ft was 3709 gal/yr.
4. Three-year operation of the glasshouse plus four fiberglass houses (two of the latter were operated at just above freezing temperatures) consumed under 4000 gal/yr.

Cost comparisons are difficult because two fiberglass houses are carried at temperatures similar to the glass house and two just above freezing. Being mindful of this fact, one must realize the area has been increased 500%; while fuel useage has only increased by 60% from that used by the glass house in 3 yrs of operation.

The real labor saving is in the operational features of the propagating houses. Our facility operates at full capacity all year. Our output is approximately 200,000 plants annually. These are all in 3" clay pots and are heavier than liners available on the open market. Our liners go directly to the field and are machine-planted. Our losses are nil and the growth rate is excellent.

The total facility has been handled by one woman. She makes, pots and beds all cuttings; performs all watering, feeding and seeding tasks.

The whole layout is not impressive as a showplace, but it makes up in what it is short on appearance by being long on performance. We are able to lock the doors and be away for a full week at any time of the year.

PRESIDENT TUKEY: We are a little behind schedule so we will have to hold questions for later. Our next talk — by Jim Kyle — is entitled, "New Propagating House Using Plastic Pipe Bottom Heat".