CONTROLLED TEMPERATURE OVER-WINTERING PROGRAM

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When I was approached last May to give a short talk on the subject of a "Controlled Temperature Over-Wintering Program", it seemed like a perfectly good topic for the 1973 Propagators' meeting. Little did I realize at the time that we were heading for a full-fledged energy crises come winter.

Before I comment on how this crisis might affect the over-wintering program, I would like to describe it to you. The program concerns mainly vulnerable container-stock and this refers to: (A) broadleaf material that is somewhat tender, e.g. evergreen azaleas; (B) broadleaf and deciduous stock that is root-tender at low temperatures; e.g. Japanese and American holly, cotoneaster varieties and pyracantha.

This stock is pushed together tightly in Quonset structures during early November. The huts receive a thorough spray of 3 lbs. Captan plus 1 lb. Terraclor per 100 gal with a quality sticker like Vapor-guard or Nufilm added; this spray is applied just prior to covering. The huts are covered with two sheets of opaque copolymer 4-mil film 26 ft wide. The edges of the sheets are draped in shallow furrows dug alongside the huts with an angled snow blade behind a tractor. The tractor covers the furrows up again which secures the plastic one way. Next 1 x 2 inch wood strips are stapled onto the kickboards by means of an air powered staple gun.

Poly sheets are laced down with 3 inch strips of gusseted poly. The ends of the huts have dutch-doors; the top part folds down to allow for easy ventilation and quick closing when the weather turns cold or wind velocities increase rapidly. The huts remain ventilated as long as possible, usually on an on-and-off schedule up to Christmas and whenever the weather warms up during the winter. In the huts a small, shaded-pole blower (60 to 100 CFM, 3,000 RPM) mounted on a small piece of plywood is installed in such a fashion that it blows air constantly in between the two layers of poly, keeping them 2 to 3-1/2 inches apart. This provides the air space required for optimum insulation and the efficient use of heaters.

The heater we use is a fan-forced portable LP gas heater with a 150,000 BTU output capacity and 7 lbs/hr fuel consumption. This heater is hung on one end of the hut about 10 inches down from the top. We do not install a flue but line up the heater with a 5 inch "peep-hole" in the door. We leave this hole open during

cold weather so that the heater fan can draw in fresh air. The peep-hole facilitates the daily check-up without having to wrestle with snow blocked doors to enter. For a number of years we have been controlling the heater with a plug-in type thermostat which we locate away from the rather narrow heat jet stream moving through the top section of the hut. Depending on the size of the plants the thermostat will be approximately 10 to 18 inches above the top of the plants.

The temperature is set at 31^0 F which is the minimum setting for this type of thermostat. Some cost figures: gas heater, $134.65; plug-in thermostat, $11.25; pole blower, $9.00 to $10.50.

Now an explanation of how this heater works during cold weather. When activated by the thermostat the powerful fan pushes out a narrow jet stream of hot air through the top section of the house. The penetration effect of this stream is excellent. We have used this type of heater mostly in 100 ft huts and then the opposite end of the hut has the highest temperature reading. However we are using the same heater in huts that are 160 and 180 ft long with no more than a 4^0 to 5^0 F drop on the opposite end. The significant point is that we are heating only the top air layer in the hut. There is very little mixing of this air with the air in the plant zone. All we are doing is providing the container-stock with a warm air blanket in the top of the hut. During cold snaps when outdoor temperatures at night drop to 10^{0}F or much lower we will have frost at the plant level with 1 to 1-1/2 inches of frost crust forming in the cans; night temperatures will go down as low as 26^0 to 28^{0}F. This is exactly what we want. We have no desire to baby and "tenderize" our container-stock. All we want to do is to prevent a deep-freeze effect in our cans where the medium will freeze up to 2/3 of the way or sometimes even freeze solid.

Another advantage of zone heating is that there is practically no drying effect from the moderate amount of heating done. We usually turn sprinklers on, or hand water once in December and once more the end of February or early March prior to opening the dutch-doors permanently; this last watering is more to insure uniform moisture content during the hectic shipping season when we don't want to be bothered with having to do spot watering.

Back to the over-wintering huts: There seems to be enough air turbulence taking place to prevent any significant occurence of molds and fungi in the rather tightly packed houses. We maintain only a close watch and repeat our spray program on the evergreen azaleas.

The pole blowers and the heaters are not activated until truly cold weather sets in. At the 31^0 setting the heater will run from

2-1/2 to 3-1/2 hr over a 24 hr period with outdoor temperatures ranging from 5° to 20°F. At below zero readings maximum running time in a 100 ft hut will not exceed 4-1/2 hr.

LP gas tanks (1000 gal), which remain the property of the Gas Company, are installed for an installation fee. Each tank feeds five huts. Depending on the severity of the weather, tanks are refilled sometime during February before we go below 20% capacity; this is considered a safe minimum. If drawn too low contaminants, like sulfur, could be drawn into the house. This brings up the possibility of releasing other harmful combustion gasses into the huts since we do not install flues; we have never noticed any ill effects on the plants at the low temperature settings that we use in these huts, not even at the 45° to 55° F temperature that we maintain in some clear poly huts that we operate from late February through mid-April.

In those huts we store our early cannings. I am talking about 20-30,000 cans of cotoneaster cultivars and items like euonymus that we pot when the weather moderates at the end of February or March; this will keep our steady crew busy until the shipping season begins. With the help of this LP forced-air heater we can utilize these houses as forcing houses and obtain an extra bonus of spring growth by the time the poly comes off in mid-May.

Another important application is the storage of large numbers of peat-potted transplants placed in wire flats and overwintered under clear poly at 38 to 40° F. These are forced in March and April by gradually boosting the temperature to 40° to 55° F. Another advantage is that except during very cold weather we can send our men into these huts, turn the thermostat up to 45° F and have them do grading, labeling, trimming and fertilizing.

After the first week of March we turn the heaters off regardless of the weather and leave the dutch-doors open around the clock; by then the roots will have become active and the broadleaf stock has a true "life" appearance in contrast with similar unheated stock that, in our area, often is frost-bound until March 20. We can start shipping immediately to our customers who are a couple hundred miles south of us without having to wait for the cans to thaw out.

I would like to emphasize again that by turning the "heat-faucet" off, so to speak, and ventilating drastically in March, this stock will not be more than 5 to 10 days advanced over conventionally stored container-stock.

Now for the cost factors which are so important in justifying this method of over-wintering and, as mentioned before, what effect the developing energy-crunch might have on its feasibility.

In the past 3 years it cost us 3 to 4-1/2 cents more to overwinter a 2-gallon can in controlled temperature storage as compared to conventional storage. The variation being the amount of heating required under the different winter conditions. None of those winters could be considered truly severe. This cost figure will vary in each of the several nurseries in northern Ohio which have adopted this method since all of them use different temperature settings.

With the energy crisis entering the picture this storage method becomes a new ball game. But first let me say that horticulture in general, and propagation and container production in particular, are becoming a different ball game. Purchasing propane gas for our program is actually in the same category as securing fuel for greenhouses and for trucking next spring, or obtaining plastic cans and fertilizers for next season or poly sheets for covering ones' huts next fall.

We were fortunate enough to get our propane tanks filled last month by paying 40% more than last February. We are going to try to keep the controlled temperature storage going as long as possible by rolling with the punches. We are replacing most of the plug-in thermostats with ones that we can turn down much lower and then experiment with settings as low as 27° F. Also we will use the manual switches to keep the heaters turned off during the daytime and during minor cold spells. If we can reduce our propane consumption to just one fill-up per tank during the slack summer season, and if the price does not go beyond 50 cents per gallon, we might be able to keep this way of storage going. If the consequences of the energy crisis turn out to be more drastic than we can anticipate from here, then all bets will be off for this type of program as well as for a number of other growing methods established in our industry during the last 20 years.

PETE VERMEULEN: I was puzzled by your statement of having frost at the ground level, with the forced air coming in. Do you get no mixing for the entire length of the house?

GIED STROOMBEEK: There is a distinct difference between the temperature zones through the whole house. There is no or very little mixing of the zones; we have checked this out with thermometers set at various levels.

PRESIDENT TUKEY: Our next speaker is Francis Gouin from the University of Maryland; he is going to tell us about winter protection of container plants.