Thursday Afternoon, December 13, 1990

The afternoon session was convened at 1:20 p.m. with Michael L. Byers, serving as moderator.

THE USE OF BUBBLE-PAC FOR THE OVERWINTERING OF ROOTED CUTTINGS

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Bubble-pac has the potential of eliminating some, if not all of the problems associated with microfoam. To begin with, bubble-pac is ½ air and possesses many of the insulating benefits of microfoam. It has found some use in the glass greenhouse industry by being applied to the inside of the glass to provide insulation that is clear. Unlike microfoam, it does not tear easily and it has a proven long life expectancy. We have used the same pieces repetitively for 5 years, and it is still usable.

While an important part of the over-wintering process, bubble-pac is not an answer in and of itself. Effective overwintering of cuttings can only be accomplished by efforts having been started during the spring and summer. Several principles should be followed to insure effective overwintering of cuttings with a minimum of losses. At Moon Nurseries the methods used are as follows:

1) Cuttings should be taken as early as possible with an emphasis placed on cold-sensitive plants such as *Viburnum carlesii* 'Compactum', *Acer palmatum* cultivars and cuttings of plants from more southern latitudes. Some researchers have found that early rooting of cuttings enhances the ability of the rooted cuttings to over-winter (14, 16,18).

Once our cuttings are rooted, they are removed from the mist, hardened-off by being placed on the floor in a ventilated, air-inflated poly house. It is important to stress that all of our cuttings are direct stuck, so that no transplanting after rooting is necessary as the transplanting of cuttings after rooting can lead to serious overwintering losses (14).

2) After rooting, cuttings receive regular attention with the exception that they are not fertilized. It has been shown that nitrogen, especially in the ammonium form (NH_4^+) is detrimental to many newly-rooted cuttings during the overwintering phase (2, 14,16).

3) Reducing water and in some cases withholding water will cause an increase in the rate of vegetative maturity (2, 18). Vegetative maturity is one of the first steps towards the fall-conditioning of cuttings for winter.

4) High hormone levels used during rooting and the use of NAA (naphthaleneacetic acid) may cause extended dormancy such that cuttings will not releaf in the spring (15).

5) A natural reduction of photoperiod is necessary for proper hardening before winter. If the cuttings are artificially illuminated to induce rooting or growth this extended photoperiod has to be reduced gradually to mimic natural conditions (1, 18, 19). This process should be started during warm weather and allowed to follow into cool weather.

6) Cuttings should be exposed to increasingly cold temperature so that a sufficient stage of dormancy can be reached (2, 6, 7, 18, 19). We have found that temperatures as low as 28° F can be tolerated by most hardy plants, if the change is gradual.

7) Once all of the above factors have stimulated acclimation of the cuttings, they are watered heavily, weeded if necessary, and allowed to drain for 1 to 2 days. Fungicides to control *Botrytis* are applied and generous amounts of rodent bait packs are distributed amongst the cuttings (2, 6, 7, 11).

8) Half-inch bubble-pac is applied directly over the cuttings with the bubble side down and it is allowed to overlap the edges so that it lays flat on the ground. The bubble-pac is immediately covered with 70% milky poly which is also extended over the edges so that it too lays flat on the ground and seals the cuttings in (2, 6, 7, 12, 13, 20) Figure 1. The white poly covering reduces temperature fluctuations caused by sunlight (2, 10, 11, 18, 20). Also desiccation is prevented by sealing the plants in a plastic envelope. Desiccation is a significant cause of death in rooted cuttings. By being sealed underneath the covering, the water vapor pressure deficit can be eliminated (9, 19). Finally, ground heat is trapped underneath these blankets and this serves to insure against cold damage (2, 10).

9) The timing of the covering process is usually carried out after 2 or 3 frosts within the greenhouse (2, 6, 7). In our region, this usually coincides with the Thanksgiving holidays. It is hoped that by this time most of the leaves of the deciduous plants will have abscised or, at the very least, turned color. Evergreen cuttings should have stopped all terminal growth and buds will have set.

10) Once the cuttings are sealed, no heating within the greenhouse is necessary. The greenhouse fans and vents are set to come on at 50 °F to prevent heating during the daylight hours.

11) Cuttings remain under this type of enclosure until March 1st. It is imperative that cuttings not be allowed to break dormancy prematurely (2, 6, 7, 9. 17) while underneath the covers as severe

Figure 1. Several beds of rooted cuttings covered with bubble-pac and milky poly.

damage can occur with harsh spring frosts. Often periodic checks are necessary to determine proper timing for cover removal. A good indication of when to remove the covers is if flower buds are breaking dormancy, as flowers will form long before the leaves will appear. If blossoms do appear, it is time to remove the covers.

ADVANTAGES TO BUBBLE-PAC

1) Cheaper than microfoam, $0.11/sq ft versus $0.05/sq ft

2) More durable than microfoam, very difficult to tear or rip, with a life expectancy greater than 5 years if kept in the dark when not in use.

3) Bubble-pac is as effective as microfoam for overwintering. Plants such as *V. carlesii* 'Compacta', *Cornus florida* 'Rubra' and *Chionanthus pygmaeus* can be easily overwintered under bubble-pac.

4) Root growth of many species will occur under the bubble-pac during the winter. Understock being held for grafting will often have ample white active roots so that grafting can commence immediately upon being removed from the covers.

5) Because the bubble-pac is completely sealed, winter desiccation can be eliminated.

6) Some work at our nursery indicated that fall grafts of *Prunus*, *Hamamelis*, and *Betula* can be successfully overwintered under bubble-pac.

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Dale G. Deppe served as moderator for the following *Helpful Hints: Problems and Solutions* Panel. Papers by: John Larson, Brian M. Decker, Ned D. Rader, Robert P. Kuszmaul, Jamee Nirider, and David C. Ruppert were part of that panel.