MODERATOR HESS: Perhaps our balance of payments is not in too bad shape when you consider the fact that we have obtained and England has lost — or has almost lost — Jim Wells. Jim has the ability to express himself effectively and convincingly both in the written and spoken word. He has, perhaps more than any other member of the Society, shared his experience through a book, numerous articles in the *American Nurseryman* and by participation in the Society. It is an honor to introduce another Award of Merit recipient, James Wells.

MIST PROPAGATION PROBLEMS

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Back in 1947, when we commenced to use mist, one of the aspects which immediately became apparent was the absence of problems, particularly problems which we had anticipated. By this, I mean that we first thought that the regular application of relatively large quantities of water would produce a great deal of rotting and fungus troubles of all kinds. But this was not the case. In fact, one of the most striking features of mist propagation is the comparative absence of these problems as compared with more orthodox methods of propagation.

But as time went on, we found that a mist system did have its drawbacks, although in many instances they were quite different from those to which we had become accustomed.

MECHANICAL PROBLEMS

I think that it is in this category that most of the serious problems occur. Insufficient coverage, due to poor water pressure, is the first. Others are . . . poor coverage due to improper jets . . . highly mineralized water which quickly clogs the jets . . . improper placing of the jets over the area to be covered . . . insufficient units to overlap in all areas. These simple and truly mechanical problems resulted in many growers being somewhat disillusioned with their results. Yet these problems are quite easily overcome.

Water Pressure:

First, the question of water pressure. There is hardly a nursery which does not have a pressure of 25 to 30 PSI and there is an excellent jet which will give good atomization at this pressure. It is the Monarch H-261. However, the coverage of this jet, at this low pressure, is quite small and it is essential that jets be placed in pairs, at intervals of about 18 inches, on a 3 foot bench, the jets pointing to either side at a 45 degree angle.

On most greenhouse benches, this will give good coverage. If the bench is long, it is wise to start the delivery pipe with one inch lines, reduce down to ¾ inch, and if it is very long, reduce again to ½ inch at the far end. An alternative to this low pres-

sure problem is a good booster pump and I would advise this, if it is at all convenient, because there is really no substitute for good water pressure. By this, I mean water pressure at from 60 to 80 psi, and preferably up to 100 psi. (I always wanted to put in a booster system to operate at 500 to 600 psi, because surely this would be the best. But I have had neither the money or the opportunity to do so.)

For reasonable pressures in the 60 to 80 pound level, the Florida Jets and the MacPenny Jet are both excellent and a single line of these jets at approximately 4 feet, on a 4 foot bench, will give excellent coverage.

Mineralization:

Water may come in, absolutely clean, but it is essential that the jets be cleaned at least once a year. Mineral deposits do build up on the screens and reduce the pressure at the orifice.

Control Unit:

In the realm of mechanical problems must come those associated with the control unit used. I am sure that many of you have had troubles with Harvey Templeton's electronic leaf. There are now many versions of his original idea on the market, and all of them seem to have some problem or other. There is no question, however, that the electronic leaf control is the only one to use. For it is immediately responsive to any change in the atmospheric conditions. Once the sensing element has been correctly placed, it should give the very fine degree of control which is ideal.

Most of us have found that the electronic leaf control units manufactured in this country have been, at best, temperamental. I am afraid that there are a large number of these control units sitting on shelves, while the disillusioned grower has gone back to the previously discarded time-clock. This is a pity, because the time-clock is not as satisfactory as a good electronic leaf.

In my opinion there is only one good electronic leaf control unit. This is a fine, transistorized version of Harvey Templeton's original circuit, manufactured in England. We have been using one of these MacPenny Control Units now for two years without touching it at all. The sensing unit has been cleaned only once in this period and it continues to work regularly and precisely.

MEDIUMS

Drainage:

I am sure that many growers have run into problems with poorly drained mediums under mist, where perhaps a situation existed in which the surplus water which mist systems must apply, could not drain away rapidly after passing through the medium. Such a condition is fatal to success. Good drainage is absolutely essential for successful propagation under any form of misting.

Correct Medium:

But perhaps more important is the choice of the right kind

of medium for the plant one wishes to grow and this choice appears to be more critical when a mist system is used.

Examples:

I would like to give you two examples.

1. Evergreen Azaleas of the Hinodegiri type can usually be rooted with great ease in almost any medium. Certainly millions of cuttings have been rooted in plain sand, although most growers will consider that a 50-50 mixture of sand and peat, or peat and perlite is best. These cuttings can be rooted with the absolute minimum of attention, directly in open field beds, under any adequate mist system, but only if the medium is 50 percent peat and 50 percent sand. If plain sand is used under these conditions, rooting is poor and the addition of some peat appears to be essential for good results.

2. I ran into an even more striking example, some years ago. I was attempting to root cuttings of *Chamaecyparis obtusa nana gracilis* and I had followed the procedures in the Boskoop Trial Ground Reports, that suggested soaking the cuttings in a solution of Indolebutyric Acid at 7,500 parts per million for 18 hours. This was done and the cuttings were inserted in a medium of 50% peat and 50% sand. It just so happened that I was experimenting with other mediums of live spaghnum moss for the rooting of Rhododendrons, in an adjacent area. Quite by chance, one of the cuttings of the Chamaecyparis was inserted so that the stem penetrated the spaghnum moss.

Eight weeks later, when I came to lift the cuttings, this was the only one which had rooted, out of the whole lot, and it had rooted with astonishing vigor. I was so taken with this that I immediately repeated the test by inserting cuttings, this time in shredded spaghnum moss, with first-class results. It is interesting to record, also, that under these conditions, the Rhododendrons would root in the sand and peat mixture, but did not root in the spaghnum moss.

These illustrations will show that it is essential to provide exactly the right type of medium for the plant and the conditions provided by the mist system. Because of the unknown, perhaps minute, yet quite important, variables which may arise . . . type of water available . . . type of peat one is using . . . the length of the cutting stem . . . and insertion into the medium, it is essential for the grower to experiment and record his results so that he can establish optimum conditions for his particular set of circumstances. Once these and the other mechanical problems have been solved, then one usually finds that the use of a mist system prompts rapid and vigorous rooting.

CULTURAL PROBLEMS

Hardening Up:

Once we have reached the point of having established good rooting, we run into a set of problems resulting from the removal of the cuttings from the misting environment to more natural ones . . . in other words, "hardening up."

Use of a Weaner Unit:

There is an electric control called a Weaner Unit, which is nothing more than an electric counter. It enables one to couple the Solenoid to the Control Unit, and by turning a switch, to apply mist to a bed of rooted cuttings every 3rd . . . every 6th . . . or every 12th time . . . that the sensing unit calls for mist. This reduces the amount of mist which is applied and slowly hardens up the cuttings. I have spoken with a number of growers who have used the Weaner and they are very pleased with it.

Use of Shade in Place of Mist:

There is another aspect which I would like to call to your attention. That is that shade can be substituted for mist, to a considerable extent. The purpose of the film of water maintained by a mist system, is to keep the cuttings in a turgid condition and prevent undue water loss. This works very well, indeed, particularly when the cuttings have no root system. But once they have rooted, then they are organized once more, to extract water from the medium, and the need for preventing any evaporation from the leaves is not as acute. The cutting can sustain normal transpiration and can supply the required moisture from its new root system, without stress. We can provide reasonable conditions for such rooted cuttings by applying a very heavy shade and misting either with the Weaner Unit or manually, perhaps once an hour. Then, a few days later, perhaps twice in the morning and twice in the afternoon. Then, once or twice a day, only. A regime of this kind, over a two week period, will usually bring the cuttings to a position where they are well able to stand on their own feet, in normal conditions.

Use of Special Area Designed To Combine Shade and Mist:

An alternative to these procedures would be a hardening-off area, which should be separated from the propagating area. If the cuttings have been rooted in flats, then the flats can be moved to the hardening-off area, which might be a section completely surrounded with Saran. A high overhead mist line should be provided, which could be controlled with a time-clock and the cycle of mist application steadily lengthened, until it is about once an hour, before it is discontinued.

There are no problems with hardening-up, which in my opinion, cannot be overcome easily with a little care and common sense.

Fungus:

I commenced by saying that fungus problems appeared much less than we might have anticipated and this is true with one important exception.

Incidence of Rhizoctonia:

We have found that under the close conditions of a closed greenhouse, Rhizoctonia can appear quite suddenly in the bench and spread with amazing rapidity. The benches of cuttings have to be watched for the incidence of this disease and action

taken immediately to prevent undue loss. All dead or damaged cuttings should be removed at once. Any leaves which may have fallen from nearby cuttings should be removed and the whole area cleaned and groomed.

Semesan Control:

Then the immediate area of attack should be treated with double strength Semesan and the whole greenhouse treated with single-strength Semesan. We have found that this mercury compound is superior to any other in the control of this disease and if the treatment is applied rapidly, the disease is stopped in its tracks.

This seems to end the problems with which we have been faced, with the exception of the item which is to be dealt with by the next speaker, and that is "Leaching."

There seem to be certain types of cuttings which are just not responsive to mist culture and I believe that these have to be determined by trial and error. Deciduous Azaleas are among these. The cuttings are taken in a very soft condition. They are always slow to root and with the steady application of mist over a period of two and a half month to three months, the cuttings almosts invariably collapse before rooting.

I mention this because I have no answer for it and I am therefore waiting eagerly to hear the comments of the next speaker, who I hope will give me the answer to the problem.

MODERATOR HESS: Another problem which has been called to our attention by the excellent work of Dr. Harold Tukey, Jr. and his graduate students at Cornell University is leaching by mist. We are fortunate to hear from Mr. George Good who is actively working on this problem.

THE INFLUENCE OF INTERMITTENT MIST ON THE MINERAL NUTRIENT CONTENT OF CUTTINGS DURING PROPAGATION

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INTRODUCTION

Foliar leaching is the removal of metabolites from plant parts by aqueous solutions, (Tukey, 1962). Leaching has been shown to be of importance in plant nutrition, in the distribution and recycling of nutrients in an ecosystem, and in the quality of certain food crops. It has also been shown that many factors may affect the leaching of nutrients. For instance, the age and the maturity of the plant tissue can influence the amount of leaching which occurs from plant tissue. Young, actively grow-

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