

MR. HESS: I believe that you will have to allow more light through and probably use a little more moisture.

MODERATOR SNYDER: May I suggest in deference to the other three speakers we let them present their discussions; then you can direct questions to whichever one you want.

Mr. Ward, of Lake's Shenandoah Nursery, Shenandoah, Iowa, was unable to be with us this afternoon. While it is not the general policy to have papers read, we feel his paper is of sufficient interest on the subject that it should be included.

We are very glad that Dr. Mahlstedt of Iowa State College has agreed to read the paper because he is familiar with the work on which this paper is based. Therefore we will have someone to question in connection with the report of Mr. Ward.

Mr. Ward's paper, entitled "Mist Propagation in Open Frames", was read by Dr. Mahlstedt. (Applause)

## MIST PROPAGATION IN OPEN FRAMES

WILLIAM F. WARD

*Shenandoah Nurseries, Shenandoah, Iowa*

### INTRODUCTION

Members of the Plant Propagators Society, Ladies and Gentlemen. I was very happy when several members suggested to Mr. Fillmore that I present the topic "Mist Propagation in Open Frames", a method of propagation with which we have had two years experience. Since we were dissatisfied with the old closed case or tent house method of propagation it was quite natural for us to attempt to root cuttings during the summer under the new mist technique. At the Shenandoah Nurseries we began investigations in 1953 with a mist bed 6 x 15 feet, expanding those facilities to a bed 6 x 105 feet during the 1954 propagating season. With very few exceptions, we have consistently obtained better results with mist propagation than with our frame method under shaded sash. With two years experience behind us the management has expressed the desire that we expand our mist propagation setup to take care of the largest part of the summer propagation schedule dealing with the rooting of deciduous shrubs and selected types of evergreens.

I will speak briefly about the method by which we make the cuttings for mist propagation, the method of hormone application, and the spacing in the bed. Then with your permission I would like to describe the units which we have used during the 1953 and 1954 test as well as the mechanics of applying water, hardening-off the cuttings after rooting and a few of the problems we have encountered with each unit.

### GENERAL CONSIDERATIONS

*Making the cutting.* Cutting material is collected from stock plants in the field. These are selected about the same time as we would ordinarily collect cuttings for the old method of propagation which is based on the deve-

lopment of the stock plant. The material is then brought to the bench where the girls orient the cuttings. They are then cut to a uniform length, varying between 4 and 6 inches, depending on the plant material by the use of a paper cutter. Since the old cutter which has been used to make over 3 million cuttings is in use, I could not bring it along to demonstrate the method of making the cuttings. However you should take the same care in making the cuttings with a paper cutter as you would with a knife; the method of course has the advantage of being considerably faster and larger quantities can be turned out.

*Hormone application.* The method by which we apply rooting powders makes use of a large salt shaker which is filled with the particular rooting powder we are using for a certain type of cutting. A thin film of powder is shaken on a clean piece of paper. A handful of cuttings is then taken, tapped gently to even up the bases, moistened at the base with a stationery rubber sponge and rotated gently in the powder. When the paper becomes soggy or wet it is discarded with no great waste of expensive chemical. Since the paper cutter makes a straight cut, rather than a diagonal one, all the cuttings get uniform coverage and ample material to do the job.

*Sticking the cuttings.* After the cuttings are made they are transferred immediately to containers and stuck in the mist bed. The spacing we use in the bed between cuttings and between rows varies from 1 3/4 inches for types as privet, which have a relatively compact, small leaf area to 2 1/2 inches for such cutting types as weigelas and viburnums or snowballs, which have a large leaf area.

#### EARLY TESTS WITH MIST, 1953

*First mist bed. Construction.* The first mist bed that we constructed at the Shenandoah Nurseries was made from an ordinary coldframe 6 x 15 feet. The bottom of the bed was excavated to form a "V" bottom, the bottom of which was filled with broken pots and small rocks to permit adequate drainage. The frame was then filled to a depth of about 6" with a good grade of propagating sand, in our area known as Platte River sand. The frame was then enclosed with 4' muslin siding which could be rolled up to permit the operator to get into the bed either to stick the cuttings or to inspect them periodically for rooting. The mist was provided by a row of "T" jet nozzles spaced about 15 inches apart on 3/4" pipe. The pipe was connected to the water supply by means of reinforced spray hosing.

*Operation of mist.* The bed was put in operation on June 5th and was operated as a constant mist unit through the middle of August. During this time some difficulty in lateral movement of mist was experienced in that a fan shaped pattern of atomized water from the nozzles was not distributed evenly on days without air movement. The leaves on all cuttings however were continuously wet during the rooting period.

*Observations and problems.* Since we attempted to evaluate this method of propagation against our old setup, small numbers of a great many species were tried. In brief we successfully rooted 73% of the species and varieties we tried. However after rooting, the problem of hardening them off was of more serious importance.

Although various methods were tried, only the method in which we hardened the cuttings off in place proved successful. Poor results were obtained when we flatted the rooted cuttings and moved them in and out of the mist bed. Another method was tried in which the cuttings were potted and placed under sash and shade; this, too, proved unsuccessful and not adaptable to a large scale operation.

*Hardening-off cuttings.* After having such poor results with various techniques for handling the cuttings after they have been rooted under continuous mist I concluded that the only way to cut down these losses would be to harden them off in place. In order to work out a suitable sequence for this operation I stuck a full bed of *Hydrangea paniculata grandiflora* cuttings in the usual manner. As soon as we noticed that rooting was starting, the water was held off for varying periods of time making certain that during this period the cuttings did not wilt. As soon as the cuttings had an established root system I cut the water off at 5 p.m. and again started the unit around 9 a.m. After a short period of time (about 2 weeks) following this procedure we potted them off and placed the cuttings in frames covered with lath and burlap. As a result of this method of handling we realized about 90% survival, from cuttings which were in the propagation bed a total of 31 days.

*Conclusions.* From this one test we concluded that cuttings can be satisfactorily rooted under 24-hour mist. However when considering the economics of the method it would be desirable to start the cuttings under constant mist, and then slowly reduce the time interval until such a time as the cuttings have been hardened off in place in the propagation bed. Continuous mist propagation followed by immediate potting had no practical method for hardening the material off with any degree of success.

#### RECENT TESTS WITH MIST, 1954

*Construction of the bed.* Early in the spring of 1954 we constructed and equipped a mist frame which was 6' x 105'. In construction the bed was quite similar to the one that I described earlier, although a different nozzle was used and automatic controls to provide intermittent mist was installed. For this purpose we have used successfully the "Florida 550 A" spray nozzle spaced at 5' intervals in 3/4 inch pipe located about 6 inches above the cuttings. In sticking a frame of this type all the nozzles can shut off from the main control point. As the cuttings are placed in the bed the main valve is opened and the cuttings syringed by hand until they have passed the periphery of the spray cone. The individual nozzle then can be turned on by hand and the procedure repeated until the entire unit has been stuck. After the bed has been stuck we have turned over the misting chore to a 24-hour time clock fitted with a 1 minute timer which operates a spring solenoid valve.

The mist bed was again enclosed using new burlap 4' in width and cut into 10 foot sections. Each section was fastened to the bottom of the bed with eye screws, spaced along the bottom of the burlap section. Again sand was used as the propagation medium. Complete construction cost was \$275 not considering frame and sand.

*Operation of mist.* Convinced of the feasibility of using an intermittent system for applying mist we operated our nozzles 30 seconds out of the

minute on very hot days between the hours of 5 a.m. and 9 p.m. On cloudy days and 80 degree temperatures the mist was operated 10 seconds out of every 60, while after the cuttings began to show root formation this often was cut to a 4 second on, 56 second off cycle.

*Hardening-off procedure.* This procedure is difficult to describe and actually is acquired only through careful watching. In practice we start to cut down the mist at a time when the roots are just beginning to show; gradual reduction then takes place until a point is reached where the cutting has a good root system and the mist is applied only on very hot days and only in quantity enough to prevent wilting. During this time immediately prior to potting when the cutting is being hardened off the material is fertilized about three times with a liquid fertilizer.

*Results obtained* from this method of handling were far superior to any tested to date. *Viburnum*, *Weigela*, *Forsythia*, *Cornus*, *Berberis* (Red Leaf), Willows (*Salix*), Honeysuckle (*Lonicera*), and privets (*Ligustrum*) all were rooted very successfully following this intermittent mist technique. We did notice that even though the beds ran in a north, south direction, the cuttings in the center of the bed that received the most sunlight often were the ones which produced the greatest number of roots. In addition we were impressed with the importance of timing, especially when sticking cuttings of those deciduous shrubs which were particularly sensitive to this phenomena. For example:

Variety	Condition of wood	Date Stuck	Percent Rooted
<i>Berberis thunbergi</i>	Soft	6/29	90%
var. <i>atropurpurea</i>	Soft	7/29	75%
<i>Philadelphus lemoinei</i>	Soft	6/22	80%
var. <i>Enchantment</i>	Soft	7/27	30%

In another experiment we attempt rooting arborvitae treated with various rooting powders the results were as follows:

Variety	Date Stuck	Date Lifted	Treatment	Percent Rooted
Thuja	6/22	11/18	Geigy L/16	82%
var. Berkmann's	6/22	11/18	Hormodin No. 3	22%
Golden	6/22	11/18	Untreated	26%
Thuja <i>orientalis</i>	6/22	11/8	Geigy L/16	59%
var. Lakes Hardy	6/22	11/8	Hormodin No. 3	32%
Green	6/22	11/8	Untreated	51%

From these results it is obvious that different responses to the hormone rooting powders were obtained. However in general, we believe that they can be successfully rooted under light misting during the summer months.

*Conclusions.* From our most recent experience with mist propagation we believe the 24-hour or constant mist application is not necessary nor is it practical. The cuttings propagated under intermittent mist appear to be more vigorous and responsive after potting than those propagated in tent houses or shaded frames. We also believe that the cuttings that are stuck each day should be handled as individual units each with its own timer and solenoid valve operating from a master time clock which can be hooked to the whole system. For this purpose we intend using beds 6' x 30'.

*Summary.* In summary then, I have discussed with you the subject of mist propagation in open frames, a method of propagation in which I have great confidence, provided careful attention is paid to details. I have described our experiences of the past two years together with our future plan for commercial application of this method of rooting cuttings during the summer months.

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MODERATOR SNYDER: What happened to the cuttings that were hardened up in the sand? Were they fed over winter?

DR. MAHLSTEDDE: Various methods are being tried. The first year under constant mist they were taken up, rolled and wrapped in polyethylene, that is, a little moisture placed in the bottom of the polyethylene, rolled over and put in a roll and put in storage, common storage at temperature outside. It wasn't too well insulated but it is a method you can use to carry cuttings over winter and lighten your fall load and give you a little more to do in the spring if you don't have enough. It is just a method of handling.

Another method they are attempting is to put the sand on top of the soil. I think it has been described here earlier. The cuttings will root and during the rooting sequence the mist will be cut down. The roots will develop in the soil later.

MODERATOR SNYDER: The next speaker this afternoon comes to us very highly recommended. His nursery in Missouri, The Forrest Keeling Nursery, is one of the outstanding in the area and he is a very personable individual and a strong member of this Society. His topic, "Mist Propagation under Lath Shade," will be of intense interest to us all.

Mr. Hugh Steavenson presented his paper, entitled "Mist Propagation under Lath Shade". (Applause).

## MIST PROPAGATION UNDER LATH SHADE

HUGH STEAVENSON

*Forrest Keeling Nursery, Elsberry, Missouri*

Our system of mist propagation at Forrest Keeling Nursery varies in several particulars from other mist systems I have seen or with which I am acquainted. These variations are not necessarily any better nor any worse than other adaptations. And I think "adaptation" is an appropriate word in this connection. It seems to me that almost all mist systems are adapted to an earlier propagation system or technique that happened to be in use at the nursery in question.