DALE MARONEK: You find that some spores are resistant to fumigation. Also when you fumigate you fumigate to only a certain level. The roots have the capacity to go below that level and actually pull the mycorrhizae back up into the bed.

INDOOR AND OUTDOOR PROPAGATION OF JUNIPER AND ARBORVITAE

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In the last 10 years, D. Hill Nursery has moved its growing operation which has blessed us with the opportunity to install new propagating facilites. In 1979, we constructed new greenhouses and growing frames with the idea in mind that we wanted to shift emphasis on production of conifers from inside energy intensive processes to outdoor less energy intensive techniques.

THE INDOOR FACILITIES

Our greenhouses are of the double poly type with fiberglass sidewalls. We root our cuttings in beds 6.5 × 90′ long by 7.5″ tall which are constructed as follows:

1. We lay 1″ of styrofoam at the base of the bed for insulation.
2. The loops of ½″ PVC Pipe for heating are then laid on top of the styrofoam. The PVC pipe is on 6.5″ centers.
3. The sides of the bed are 2 × 8″ boards (Wolmanized), held in place by lengths of ½″ black pipe driven in the ground. The pipes are spaced on 6′ centers and clamped to the 2 × 8″ boards.
4. The heat pipe and styrofoam are then covered with 4″ of pea stone which provides drainage and aids in heat distribution.
5. A layer of woven polypropylene fabric covers the pea gravel. This prevents roots from going into the pea gravel and also prevents the rooting media from infiltrating the pea gravel.
6. We use sand as a rooting medium.
7. We hand mist all of our indoor cuttings.
8. Depending on outside temperatures, we circulate water under the beds at between 105 and 125°F.

THE OUTDOOR FACILITES

Our outdoor rooting facilities begin with a standard 17 × 100′ hoop house which doubles as support for shade cloth in the summer and poly in the winter. The floor of each house has a 1% pitch and 6″ of pea gravel for drainage.

Inside each house are two beds 6.5 × 100′; they are separated from the sides of the hoop house by a 6″ air space. The beds use 1 × 6″ boards for sides and are filed with 3″ of composted hardwood bark covered by 2″ of sand.

Our mist system uses a whirl-jet type nozzle because we feel that they are more resistant to clogging then the "pin hole" type nozzle we have used in the past. It also produces a slightly heavier droplet which is more resistant to wind drift. The nozzles are installed on vertical risers coming from a supply pipe on the ground. The nozzles are set level which prevents the line from dripping when the valve is off; it also prevents the line from filling with air so when the valve opens all nozzles start misting at once. This system allows us to use a very short mist duration time and still get uniform coverage. Each house has one 2″ main solenoid valve to control the mist, but the mist for any 50′ section of a bed can be turned off by a manual valve if the cuttings in that quadrant have rooted more quickly than cuttings in another section of the house.

Our time clocks are 6 station time clocks which allow us a wide variety of mist duration and interval adjustments. The connections of the solenoid valves to the mist clocks are made through terminal strips, so if a station fails we can wire the solenoid to another station with a minimum of down time.

TAKING CUTTINGS

In years past we have always taken our juniper and arborvitae cuttings from early fall through winter and applied bottom heat to root them. However, with the rising cost of fuel to heat our greenhouses, we are expanding our use of non-energy or unheated greenhouses to propagate junipers and arborvitaes. This year we took all of our junipers, *J. horizontalis* cultivars, *Juniperus chinensis* 'Hetzii,' and all of our *Thuja occidentalis* cultivars in early spring through summer, and the balance of junipers in the fall of the year. This has eliminated the need to take cuttings during the coldest times of the year, thus enabling us to field-make all of our cuttings which allows us to make a greater number of cuttings per man hour.

Our procedures for field-making cuttings are as follows:

1. We take the cutting 6" in length and strip the lower 2" of foliage away. By doing this we wound the cutting.

2. We then place 25 cuttings into a bundle which is held together by placing a rubber band around the ends of the cutting.

3. This makes for easy handling and counting: our people average 800 cuttings/man-hour. The bundles are stored in moist burlap sacks by each individual and collected and counted hourly throughout the day.

4. When the bundles are brought in to be stuck, they are immediately immersed in a Captan-Benlate mixture. The mixture contains 2 lbs of Captan and ½ lb of Benlate/150 gallons of water After being washed, they are placed into a wire basket to drain.

5. The bundles are then individually dipped into IBA. We use a liquid concentrated dip made of IBA crystals dissolved in alcohol and distilled water. The strengths vary between 600 and 5000 ppm; each bundle is dipped for 5 seconds.

STICKING CUTTINGS

All the cuttings that are taken during the day are stuck that same day. This is so the base of the cutting is never given a chance to dry out and enables the cutting to absorb the IBA at a faster rate. This gives us a more even distribution of rooting throughout the bed.

When sticking the cuttings, we make a trench 1½" deep and place the cuttings in it. They are spaced according to the type and size of the cutting. When the row is complete, we place a board along the length of the row and tap it with hammers to close the tench up tight. Our people stick an average of 900 cuttings an hour. After they are stuck they are watered in thoroughly to help insure that air cannot dry out the base of the cuttings. After a complete bed is stuck, it is drenched with a mixture of Dexon and Benlate (2:1).

CULTURAL CARE — OUTDOOR CUTTINGS

For our outdoor propagation we depend on an automatic mist system that is reliable, consistant and relatively free of problems. The time clock allows us to adjust the frequency of mist from 2 to 64 minutes and duration of mist from 4 to 16 seconds. We cover the entire hut with 47% shade cloth to reduce the sun's intensity.

Along the length of the hut we have attached 1 × 3" boards, 36" from the top of the side board, and staple plastic to it for wind protection. The cuttings are sprayed bi-monthly with fungicides used in rotation as a preventative measure against disease. Depending on the cultivar we get root initiation in 4 to 8 weeks.

CULTURAL CARE — INDOOR CUTTINGS

When propagating indoors we feel there is no need for an automatic mist system. Due to the changes in the environment, we manually mist all of the cuttings. Working in an enclosed greenhouse, we also have the ability to control the humidity to a certain extent. Throughout the fall and winter, we carry 70 to 100% humidity. To measure the relative humidity, we use a precision hygrometer that we monitor closely throughout the day. It aides us in determining the frequency of mist. Our bed temperatures are kept between 65 and 70°F, and our air temperature between 40 and 50°F. Our indoor cuttings are also sprayed bimonthly with fungicides. Depending on the cultivar we get root initiation in 2 to 10 weeks.

RESULTS AND COMMENTS

We, as well as everyone else, strive to get a maximum strike from what we propagate. This past year we had excellent results with the arborvitates, a take of 90%. Results with the outdoor propagated junipers were not as good. We had about 50% that rooted and 25% that just callused. We attribute the poor take to not getting the cuttings in earlier, and having to take many of the cuttings from our container stock which was high in nitrogen due to the constant liquid fertilizing. Our cuttings inside have usually yielded a good strike of 75 to 80% overall. We feel we have only made it to first base on the outside propagating technique and hope to be rounding third and heading for home in years to come.

THE HYDROSOLARIC GREENHOUSE — A NEW GROWING AND PROPAGATING ENVIRONMENT

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Abstract. A favorable growing and propagating environment was created in a hydrosolaric greenhouse This closed greenhouse was composed of a solar energy harvesting system and hydroponics Energy collected by the greenhouse air from the sun during the day was conserved in the growth solution which released the energy during the night

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