never re-developed.

The results of this experiment confirm the fact that dissolved salts in the irrigation water play a major role in nutrition of plants grown in containers. Water quality must be considered part of the overall nutritional program if maximum growth and quality are to be achieved.

LITERATURE CITED

1. Whitcomb, Carl E. 1984. Plant Production in Containers. Lacebark Publications, Stillwater, Oklahoma

BUILDING A HIGH HUMIDITY PROPAGATION SYSTEM

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We have been using high-humidity propagation at Colesville Nursery for five or six years. In 1982 I presented a paper to the IPPS - Southern Region (1), on our use of the Agritech high-humidity propagation system. While this system did work fairly well for us, the maintenance cost on the motors and other moving parts in the units became prohibitive. Also, the uniformity of the moisture was very irregular.

While visiting nurseries in Oregon in 1984, Al Gardner and I saw a small fog system at Mitch Nursery, which John Mitch was experimenting with in his operation. John, very graciously, shared all the information he had with us. Back in Virginia we began to construct a similar fog system in our 20 × 100 ft. propagation house.

A fog or high humidity system operates by atomizing water into microscopic droplets. These droplets are suspended in the air of the greenhouse creating an ideal atmosphere for plant propagation. The air is kept humid while not overly wetting the soil medium. In our case we are using high water presure to force the water through very small nozzles.

Our system starts with the water-feed line leading into a low pressure switch. The purpose of this switch is to safeguard the fog system pump in case the water pump in the well fails. From here the water goes through two water filters: the first has a wire screen filter and the second has a felt filter. The fog nozzles have an extremely small orifice; even with the two filters, a nozzle occasionally clogs up.

The water continues from the filters to a solenoid valve which, in our case, is controlled by a 5-min. time clock that, in turn, is controlled by a 24-hr. time clock. From the solenoid the water then enters the high-pressure piston or plunger pump. The specifications for this pump list a maximum pressure at 900 psi but we are pumping at about 1000 psi. When we first began work on our system, we briefly had the pressure up to 2000 psi. The maximum flow capacity for this pump is 3 gal. per minute. We were able to adjust the pressure by changing the size of the sheave (pulley). The pulley size on the piston pump is 15¾-in. outside diameter. A smaller pulley would increase the pressure. This pump is run by a 1-horsepower Dayton electric motor with a 2½-in. outside diameter pulley.

The water, now at 1000 psi, enters the ½ in. stainless steel pipe. This pipe is currently suspended in the center of the house about 7 ft. off of the floor of the house and runs the length of the house. The fog nozzles are located every 3 ft. along the pipe.

The nozzles are Monarch Foggers[1], which are also used as oil burner nozzles. The model we are using is the F-80 NS series with a nozzle number of 0.85 and a spray angle of 80 degrees, which is for high-pressure situations. The flow rate for each nozzle at 800 psi is 1.56 gal./hr. Every other nozzle faces the opposite direction at approximately a 30-degree angle from the pipe. At the end of the house we have a nozzle facing each of the air-intake openings at the top of the greenhouse.

The greenhouse is vented using a 36-in. exhaust fan controlled by a thermostat set at 95°F. The air that is pulled through the house is usually dry which does cause us some problems. The nozzles that face the air intake vents do alleviate this somewhat.

There have been many talks and papers presented to the IPPS concerning the pros and cons of using high humidity or fog in plant propagation. We are convinced that it is a good system for us, but we have not yet constructed one that is completely satisfactory. There are several changes that we plan to make in our present system.

We still have an inconsistent moisture level across the width of the house because we use only the one line down the center. The first two ft. on either side of the greenhouse do not receive enough moisture and consequently our rooting percentage is still lower than we would like.

We plan to remove the center line and install a line on each side of the house about 4 ft. off of the floor. This pipe will be attached to the side of the house. The pipe we will use

[1] Source for Monarch Foggers: W.A. Westgate Co., Inc., 412 G Street, P.O. Box 445, Davis, CA 95617

is ½-in. schedule 80 PVC pipe, which has an operating pressure of 850 psi. Because of this we will have to lower the pressure in our system but we should still have enough pressure to insure a small droplet size. The nozzles will then be 5 ft. apart facing toward the center of the house at a 30-degree angle. This should give us a much more uniform fog throughout the greenhouse.

We also plan to remove the 5-min. time clock and use a humidistat to control the system. The system now comes on four times for 14 sec. each time during the 5 minutes. This obviously does not take into account weather conditions, so it demands close monitoring. We will be able to set the humidistat at the exact relative humidity we desire. This will take into account the air intake for ventilation so we will not be replacing the humid air with outside dry air.

We began using this fog system in January, 1985. Our conifer cuttings were direct stuck in cell packs and set on a gravel floor. We were using EconoMix, which is a pine bark and styrofoam mix. We use Dip'N-Grow rooting hormone at 1½:20 ratio. The rooting percentages on our juniper, chamaecyparis, and spruce were much above what we obtained previously.

Estimated Costs of Installing a Fog System in a Propagation House at Colesville Nursery[2]

1	General water filter, model # 2A17A wire screen	$ 33.00
1	General water filter, model #2A17A felt filter	25.00
1	Dayton ¾-in. solenoid valve, model # 1A578	53.83
1	Teel piston pump, model # 2P046A	304.36
1	Pressure gauge, 2000 psi, model #5×369	24.83
1	1 H.P. Dayton electric motor, model #6K699B	142.46
2	Dayton fan belts, model # 5L600	10.00
1	Sheave on pump, model # 3×386	13.77
1	Sheave on pump, model *1W962	62.92
1	Bushing for sheave model # 3×572	3.13
1	Five-min. Dayton time clock, model # 2E356	49.00
1	Twenty-four hr. Dayton time clock	24.06
1	120 ft. stainless steel pipe, 2500 psi, ½″	
30	Stainless steel tees, 2500 psi, ½″	
1	Stainless steel union, 2500 psi, ½″	498.63
3	Stainless steel elbows, 2500 psi, ½″	
1	Stainless steel plug, 2500 psi, ½″	
36	Monarch nozzles, model # F-80, 80° NS (nozzle # .85)	257.95
36	Brass bushings for nozzles	7.60
	Approximate labor cost	350.00
	TOTAL COST	$1860.54

We moved our nursery in the spring of 1985 and we were delayed beginning our summer propagation until July 22. For

[2] Source for all parts except the pipe and the nozzles: W.W. Grainger, 2050 Magnolia Avenue, Richmond, VA 23223

us this is about four weeks behind schedule. During that time we had wet and cool weather. We were running our fog system 40 sec. every 2½ min., which proved to be too long as our cuttings were much too wet. Our cuttings of *Ilex crenata compacta* and *I. helleri* decayed below the soil level, but they have now rooted at the soil line. We cut the fogging time back to 14 sec. every 1¼ min. This has proved to be better, but the edges of the medium still do dry out.

We are still experimenting with the fog system in propagation. We think the concept is a good one. With the changes we plan to make, we expect to alleviate the problems we have experienced.

LITERATURE CITED

1. Gaddy, B. 1982. My experience with high humidity propagation Proc. *Inter. Plant Prop. Soc.* 32:446-448.

A SIMPLE AND FLEXIBLE MIST CONTROLLER

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The propagation house is full of problems and pitfalls. One of the trickiest problems is controlling humidity around the cuttings. The usual methods of controlling mist cycles with standard time clocks and electronic leaves both have unacceptable trade-offs. Standard time clocks do not have enough flexibility, and electronic leaves and screen balances are too expensive to be used on a large scale. The mist controller outlined below is very flexible and is reasonably priced.

The Controller. The mist clock is a Richdel, Lawn Genie, 6-station lawn sprinkler controller (Figure 1). This controller is a common residential unit. The standard 24-hr. motor (M007) has been replaced with a motor (M001) that cycles every six min. The cycle is adjusted to mist once every two, three, or six min. This adjustment is easily accomplished by simply adding or removing tripper gears. Each station has an independently variable misting time that is adjusted by simply turning a dial. The mist can be set to come on for as little as one sec. to as long as 30 sec. per station.

The System. A single controller with a 24-hr. day-night clock to cut the controller on in the morning and off in the evening is very effective and economical. A much more flexi-